ELECTRONICS Australia

HiFi, Radio & Computers
JANUARY 1980
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Star Trek — the Motion Picture: a $20 million science fantasy

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- Courtesy light delay
- Playmate stereo amplifier
- Reaction timer

The C-1 is a giant step above all other cassette decks. It's a masterpiece in engineering that combines the know-how and advanced technique of both audio and computer experts. Technology borrowed from our industrial computer-based data recording systems makes the C-1 the most stable, reliable cassette machine ever. Three precision motors assure unfaltering transport stability and a solid diecast transport frame makes sure it stays that way. The capstan motor is an ultra-accurate PLL servo type driving a dual-capstan closed-loop system which optimises tape-to-head contact and minimizes flutter. Three-heads provide the convenience of real-time monitoring plus greater recording efficiency and extended frequency response. All amplifier stages are direct-coupled for maximum signal-transmission fidelity, and noise-susceptible leads for internal signal routing have been eliminated with in-circuit DC-controlled semiconducter switches. Bias and equalization selection is more flexible than ever with frontpanel plug-in calibration modules, and computer-type modular construction throughout means cleaner signal paths, easier maintenance and uniform quality from unit to unit. And for a complete professional-grade recording system TEAC offers a full range of options including a matching dbx noise reduction interface (RX-8) and 4-in/2-out mixer (MX-8). If you want compactness, portability and versatitly, but won't settle for anything less than the best performance available, the TEAC C-1 is a brillant way to go.

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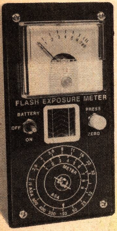
Australia's largest selling electronics magazine



Based on a solar cell, this flash exposure meter can be built for a fraction of the price of commercial units but has comparable performance. Details on p46.

Introducing Playmate, our new low-cost amplifier that's just right for a second system or as a beginner's first system. We tell you how to build it on p52.

COMING NEXT MONTH! — find out what's coming by turning to p34.

On the cover

"Star Trek — the Motion Picture" is a $20 million science fantasy; an intergalactic battle between the Starship "Enterprise" and an alien force. Our special feature story on the movie starts on p8. (Photos courtesy Cinema International Corporation Pty Ltd.)

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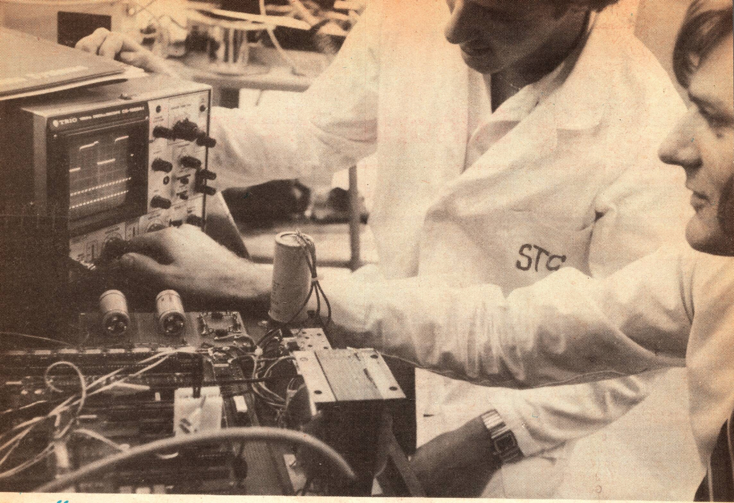


"The bright clear trace makes the Trio CS1560AII easy for operators to use..."

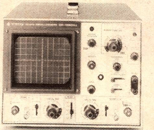
says John Shillabeer, Head of Test Equipment Engineering at S.T.C.

John Shillabeer's department is involved in the maintenance, calibration and servicing of all test equipment used within S.T.C. We asked him why S.T.C. used Trio CS1560A scopes.

"My department gets involved with all test gear purchases. As a general purpose scope we've found that the Trio provides excellent performance for its price. Being easy to trigger we find staff can readily get it up and going. On the production line, the bright clear trace makes it an easy scope for operators to use.

"Over the past three or four years, S.T.C. has bought 8 Trio 1560s and we've had virtually no trouble from them. Any minor services have been easy to carry out. As you can see we even use one in our department in the development of our own digital test equipment."

The Trio CS1560AII is one of a range of scopes available from



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CS1560A MKII – *has improved IC circuitry and a new CRT with electronic trace rotation and provision for a camera. Still provides 10mV/div sensitivity with 15MHz band width and sweep times to 0.5uS/div. Auto free-run for making voltage measurements and wide bandwidth for accurate Lissajous phase measurements.*
The most popular scope for TV, lab, educational and general use.

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Three gadgets . . . but what a difference!

Last month, we told you how to build a modern metal locator for about $20 — a modest figure by any standard. It works fine but whether it will ever lead the constructor to buried treasure is quite another matter. At best it might; at worst, you may share the experience of a reader who set out to re-examine the tailings which surrounded a shaft on a hillside near his boyhood home. On his return visit, he couldn't even identify the hill, let alone the shaft and the tailings!

He'll try again, he says but, even if he fails to find anything worthwhile, he counts it as a fun thing, and less of a gamble than $20 spent on lottery tickets.

Much less innocent are the "acoustic" lie detectors which are becoming commonplace overseas. From being specialised gadgets designed for specialists, they are getting down into the anyone-can-afford-one class, with talk of one bargain basement model for $30!

I've always had grave reservations about these "voice stress analysers", to give them their other name. It's hard to accept that a practiced liar will consistently betray himself with "microtremors" in his voice, while a tense, nervous but truthful person will never display comparable characteristics.

At best, one might concede that, with precision equipment under tightly controlled conditions, a skilled operator may obtain meaningful results. But the concept seems to have broadened to admit analysis, with cut-price equipment, of any kind of voice signal — even one played over a nondescript telephone circuit or a nondescript tape recorder, or both!

According to a recent article in the "New York Times" (and the "Australian Financial Review") there is a strong body of informed opinion in the USA to the effect that the whole principle of voice stress analysis is suspect and unproven. Dr Howard B. Rothman, a speech specialist and spokesman for a group in the University of Florida, says that the sale of such devices "constitutes the biggest fraud being perpetrated in America today".

In the face of such a statement, it is refreshing to look at a third item which attracted attention recently — the Tissue Perfusion Monitor which was featured on the ABC television program "The Inventors". It took first prize and earned for Dr Dick Stephens the award "Inventor of the Year", plus a trophy, $3500 in cash and a trip to Geneva to attend the Annual International Exhibition of Inventions.

I know only as much about the invention as was explained on television but it came through as a carefully researched and proven instrument, capable of giving doctors, and particularly anaesthetists, reliable early waring of the onset of shock. As such, it would seem to have the potential to minimise traumas and save lives out of all proportion to its apparent simplicity.

Congratulations, Dr Stephens!

Neville Williams

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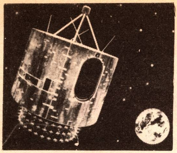
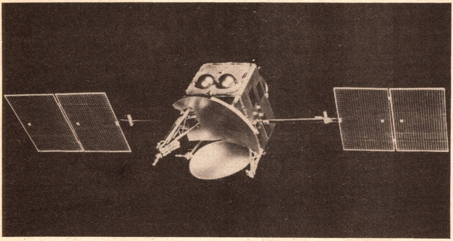
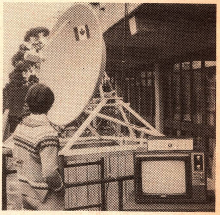


News Highlights

Canadians maneuver for Australian satellite deal





Above: pointing directly at the Hermes satellite, this small earth terminal was used to receive live TV signals during a recent Canadian demonstration.

Left: Anik B, Canada's ninth and most recent satellite.

Rivals of the Canadians in the battle for the Australian satellite have suffered another severe rebuff in their bids to capture the $150 million space segment.

by Ian Reinecke
Australian Financial Review

The Department of Post and Telecommunications has decided to use the Canadian Hermes satellite in a further two-month trial, transmitting to ground stations in North Queensland. The moves follows an impressive demonstration by the Canadians of their satellite technology during August and September of last year.

The longer trial is aimed at answering one of the major queries placed against the suggested Canadian satellite system in Australian conditions — the ability to broadcast television and radio to remote areas in periods of heavy rainfall.

It will enable the Canadians to prove their assertions that signal quality is not degraded to unacceptable levels during such periods.

For the Canadians, use of the Hermes satellite is less magnanimous than it seems because its usefulness has virtually ceased. Since it was shifted to a different orbital slot for the earlier test transmissions to Australia, it has not been used for Canadian broadcasts.

With a time frame of 1984 for the launch of a domestic communications satellite already announced by the government, alternative suppliers to the Canadians may already be terminally hamstrung in their efforts to secure the deal, this despite recent press advertisements inviting contractors to register their interest in the satellite contract.

IBM develops talking typewriter

IBM scientists have developed a talking typewriter especially for the blind and visually handicapped.

The new typewriter, known as the IBM Audio Typing Unit, makes use of the latest voice synthesis technology now emerging from the US. It can store up to three pages of typed material in memory and convert this into synthesised speech for playback over headphones or a loudspeaker at the touch of a button. What's more, the user is kept informed by means of 200 short synthesised speech messages of the physical status of the machine — where the carriage is, what line (by number) is being typed, and many other items which the sighted person routinely inspects.

Material can be reviewed line by line with punctuation (the machine utters "comma" etc), word by word, and even letter by letter. In the letter by letter mode, the machine speaks each character, says "space" when a space occurs, indicates capital letters, and gives punctuation.

IBM says that the synthetic speech facilities should add only about 20-25% to the cost of the company's Mag Card/A and Mag Card II typewriters.

8.7 megabit bubble memory

Bell Laboratories has nudged IBM from the top of the bubble memory ladder by demonstrating an experimental bubble memory device of 8.7 megabits capacity. The theoretical limit for the 28 x 30mm device is said to be 11.5 megabits! Bell's technique implants helium and neon ions in the garnet substrate. Other techniques which do not use ion implantation are also being researched.

TFF spin-off for Philips

— Americans vie for leverage

Another multi-million dollar contract has been awarded to Australian industry as the two remaining contenders in Australia's new tactical fighter force procurement — the General Dynamics F16 and the McDonnell Douglas F18A — vie for leverage to ensure selection as the final choice.

Philips Industries Holdings recently signed an agreement with the Singer Company, USA, which will lead to Australian manufacture of thick-film microcircuits used in high performance aircraft, including the General Dynamics F16. The agreement could be worth $10 million-plus over a five year period and even more if the F16 is the final choice as Australia's new tactical fighter.

Philips will manufacture the microcircuits at its Hendon, South Australia, microelectronics factory, where thick-film hybrid production commenced two years ago to complement the existing large range of semiconductor technologies. The thick-film circuits will be used in a range of inertial navigation systems.

US may licence private ground stations

Private receiving equipment for TV satellite transmissions will be restricted by licensing by the Federal Communications Commission (FCC) if the US National Association of Broadcasters (NAB) has its way.

In a petition filed with the Commission, the NAB stated that the "widespread proliferation of receive-only earth stations by members of the viewing audience" could hurt the market for TV programming, threaten the conventional system for relaying TV signals, and adversely affect local services.

There are an estimated 4.2 million households in the US with marginal or nonexistent TV reception capability — because of location — who are considered to constitute a potential market for receive-only terminal equipment.

Meanwhile Comsat, America's international satellite communications body, has disclosed that it wants to provide a direct pay-TV service to "millions of American homes" by broadcasting two to six channels directly to small rooftop antennas. Comsat said it would be ready to start the service by 1983, but conceded that it would take many years to cut government red tape.

Most strongly affected by such an undertaking would be local TV stations, which are already beginning to protest vigorously. They say they could be put out of business, and that local news coverage and expression would be stifled.

JVC enters video disc battle

The latest shot in the video disc war has been fired by JVC with a demonstration of its newly-developed VHD-AHD system.

The system seems to be a cross between the Philips and RCA approaches. The disc is tracked by a relatively large sapphire stylus incorporating a small electrode but, as in the Philips system, the program material is recorded in the form of a spiral of pits, with the stylus position controlled by a servo system which picks up control signals recorded alongside the program track.

A stylus life of 2000 hours and a disc life of 50,000 playings are claimed. The 30cm disc rotates at 900rpm, and has a playing time of one hour per side.

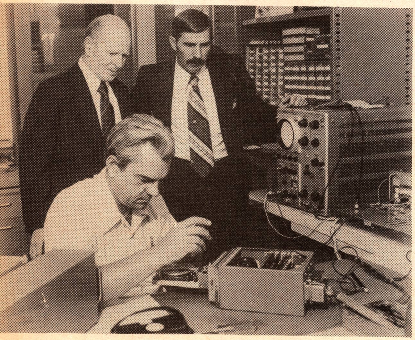
NZ gains access to Telenet database

New Zealand is the latest country to gain access to the Telenet computer database network in the US. The new service, called OASIS, is provided jointly by GTE Telenet Communications Corporation and the New Zealand Post Office, and allows users to interactively access data banks and computer systems in the United States.

Charges for the new service are approximately $27 per hour of connect time, compared with $135 for international telephone calls and $166 per hour for overseas telex services.

The addition of New Zealand brings to 25 the total number of countries with access to the Telenet network.

Lockheed's 3000th flight recorder to TAA

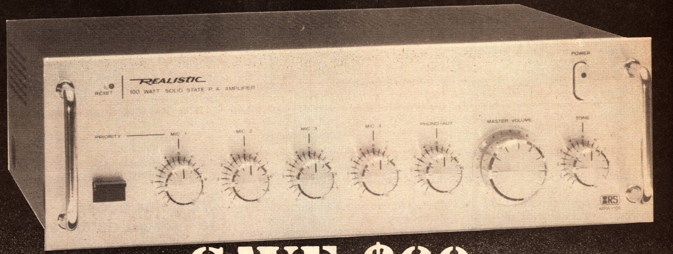


NUMBER 3000 — Lockheed Aircraft Service Company's (LAS) 3000th flight data recorder gets a final checkout before delivery to TAA, Australia's government-owned domestic airline. TAA plans to install the recorder — a Model 209 — on one of its new Boeing 727 aircraft.

The Model 209 can record more than 100 flight parameters on magnetic recording tape for the most recent 25 hours of flight. It was developed for the larger and more complex aircraft that were introduced in the late 60s and early 70s, and works in conjunction with a flight data acquisition unit installed in the aircraft that receives data from various sensors and transmitters.

Lockheed says that the 3000th delivery comes at a time when it is experiencing record sales for flight recorders. The company introduced the industry's first FAA-approved (US Federal Aviation Authority) flight recorder back in 1958.

Announcing Summer Sale PA Specials from Tandy. Shop Now and Save!



SAVE $60

MPA-100 AMPLIFIER

Sale Ends
2nd February, 1980

$199.95

259.95

Raise a hue and cry, give tongue, proclaim or simply speechify with the power and authority of this fine PA amplifier from Tandy. Its 100 watt power will fill an auditorium with sound, will carry your message to the furthest reaches of a crowd. Has exclusive "whisper page" for superior clarity over "crowd" noise. Mixing bus to stack extra amps. Five mixable inputs and master volume control. Plus "thumbsize" on/off switch with built-in power indicator light. All in a handsome brushed aluminium front panel enclosure with chrome finish carry handles. Truly a fine Summer Sale Special! 32-2023

SAVE $80

6 Speaker/Two Column 100 Watt Power PA System

$369

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A complete system,
- MPA-100 PA Amplifier
- Two 6-speaker sound columns
- Super cardioid highly directional mike with cable, screw-on mount and ¼" phone plug,

an ideal system for indoor PA with 2 handsome speaker columns finished in walnut grain vinyl veneer. (Mike Stand not included).

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NEWS HIGHLIGHTS

Soviet satellite has US experiments

An unmanned Soviet Cosmos satellite is to carry some 13 US experiments as well as those from the Soviet Union and of other countries. The experiments are all desiged to investigate the effects of prolonged weightlessness on physiological processes. The spacecraft will be launched and recovered within the Soviet Union, and will be similar to the craft used in two previous missions in 1975 and 1977.

Forty US scientists from 18 US universities and other research organisations will participate in the work. The cost of the spacecraft, its launching, recovery, and radio support facilities will be borne by the Soviet Union.

The mission will include the first attempt to breed mammals in space, this being a Soviet experiment in which male and female rats will be kept separate until the second day of the flight, when the cage divider will be lifted. Another experiment involves 60 fertile Japanese quail eggs which will begin to be incubated on the eighth day of their flight. The resulting embryos will be examined in detail after their recovery and some will be allowed to grow to maturity.

Some of the most important US experiments on this mission will be connected with studies of the changes in animal muscle fibres and animal bone formation and strength. It is expected that the experiments will provide much useful information on the reasons for the loss of calcium and for the loss of muscle strength which have been found to occur in astronauts and cosmonauts during prolonged space flights in almost zero gravity.

Arrangements have been made to recover the animals immediately after the flight, before they have time to adapt to the Earth's gravity. The Soviet recovery team will move rapidly to the landing site with a mobile laboratory in which they will be able to carry out those dissections which require immediate action. The other animals will be flown to Moscow and dissected after either six days or 25 days, so that information on the rate of normalisation to environmental gravity can be obtained.

An additional two groups of animals of the same type will be kept in Moscow. One group of these identical animals will be left in their cages and fed a normal diet, whilst the other group will be housed in an identical spacecraft on the ground and will be subjected to the same vibration and acceleration forces as the animals in the travelling spacecraft at launch and reentry.

This will help to ensure that the differences found between the animals are due to the time spent in conditions of weightlessness.

Brian Dance,
England.

Business Briefs:

Soanar Electronics Pty Ltd has expanded the range of Raytheon ICs stocked by its head office and interstate branches. Types currently held in stock include: 4136 (quad 741), 4558 (dual wideband op. amp), 4156 (quad op. amp) 4151 (V/F converter), 4194 and 4195 (variable and fixed dual tracking voltage regulators), 1488 and 1489 (line receivers), and the 555 timer IC. Many other specialised types are also available.

Soanar has also recently been appointed Australian distributor for the Thermalloy Incorporated product range. Thermalloy (USA) manufactures a wide range of heatsinks and associated products for plastic and metal-cased transistors and ICs. Enquiries to Soanar Electronics Pty Ltd, 31-32 Lexton Rd, Box Hill, Victoria 3128.

Amalgamated Wireless (Australasia) Ltd has reported a record $9.27 million profit for the 1978/79 financial year — up $2.5 million on the previous year's result. The company says that it is currently negotiating an investment in a computer company in California in order to gain technical expertise, and to guarantee a source of supply of computer components.

Plans for the construction of a new semiconductor wafer fabrication plant in Vancouver, Washington, have been announced by **National Semiconductor Corporation.** Company officials expect the 18,600 sq metre facility to be operational by 1981 and to employ around 2000 people by 1984. National Semiconductor presently employs more than 33,000 people worldwide. Consolidated net sales for fiscal 1979 were $US719.7 million.

Royston Electronics Pty Ltd, specialists in soldering and soldering tools, will be conducting a course on high reliability hand soldering from February 4-8th. Venue for the course is Unit 15, 59 Moxon Rd, Punchbowl, NSW 2196; cost will be $300. Prospective students should contact Colin Casey on (02) 709 5293.

Microwave Developments has moved into new premises at 6 Netley Rd, Mount Barker, SA 5251 (telephone 08 388 1092). The product range will continue to be the recently introduced Microwave Education Kit Type HSK (featured in our November, 1979 issue), and the established range of UHF Reversible Wattmeters. All orders should now be sent to the above address.

Aust. solar cell is 18% efficient

A new method of solar cell construction being developed at the University of New South Wales has resulted in efficiencies of more than 18%. The project, led by Professor Lou Davies and Dr Martin Green, uses a simple metal-insulator-semiconductor (MIS) system to replace the rectifying p-n junction used in conventional cells.

The aim of the project is to produce cheaper cells with an efficiency of about 20%. The theoretical limit for a silicon device is about 22%.

Research is also under way to learn how to make MIS cells from a lower grade of silicon to further reduce the cost of manufacture.

The project is supported by the Australian Research Grants Scheme and has received about $170,000 since work started in 1975.

An electric car says GM . . . but no date given

Giant US vehicle manufacturer General Motors has released details of its advanced work on two types of battery — zinc/nickel-oxide and lithium/iron sulphide. The company said that a life of 150 charge-discharge cycles had been achieved using the zinc/nickel-oxide type.

GM also revealed that it was working on a small electric car based on the new nickel-zinc batteries. This vehicle would have a range of 160km, a top speed of 80km/hr and a battery life of 50,000km, figures which imply that GM has been able to achieve a battery life of 300 charge-discharge cycles rather than the 150 mentioned in the press release.

STAR TREK

the motion picture

"Star Trek", the TV series, began before man walked on the Moon and has attracted an enormous worldwide following. Now there's "Star Trek — the Motion Picture", a lavish $20 million science fantasy from Paramount Pictures. It is the story of a 23rd century intergalactic battle between the Starship "Enterprise" and a powerful alien force speeding to Earth at "warp seven" speed.

"We had what we thought were some really outlandish ideas of the way things would be 300 years from now. Then I sent out these ideas to the Jet Propulsion Laboratory and our ideas seemed old fashioned. They have amazing things, like a computer that can draw and paint and do anything. It really shook me up."

Thus does Harold Michelson, veteran production designer for "Star Trek — The Motion Picture", describe the challenge of Paramount's new multi-million-dollar space adventure.

The setting for the Gene Roddenberry production is the 23rd century. Three powerful Klingon cruisers, patrolling their own territory, are suddenly confronted by an unknown and awesome intruder. One by one, the Klingon spaceships are destroyed, and the alien intruder assumes a direct heading for Earth!

The Starship "Enterprise", completely refurbished since its last mission and re-fitted with the latest weaponry, is rushed back into service from orbital drydock to meet the alien threat. So too are all its leading officers, which resulted in a reunion for the entire original "Star Trek" cast headed by William Shatner (Captain Kirk), Leonard Nimoy (Mr Spock) and DeForest Kelley (Dr "Bones" McCoy).

Newcomers to the cast include Stephen Collins as Executive Officer Williard Decker and Persis Khambatta as the exotically beautiful and sensuous Ilia from the planet Delta Four. Most of the action takes place in the galaxy where the intruder is confronted, although some scenes on planet Earth are shown in a sequence involving 23rd century San Francisco.

Micnelson's task, shared with art director Leon Harris and a staff of 17 expert draftsmen, illustrators and graphics designers, included the designing of an expanded, updated and more sophisticated "Enterprise". Sets for the spacecraft, some depicting parts of it never before shown, combined with other imaginative sets to fill 10 huge soundstages at the Paramount Studios in Hollywood.

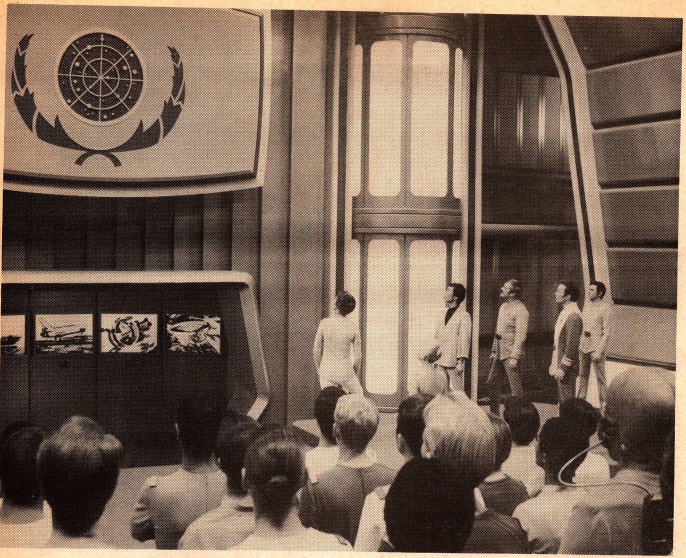
Among these were a futuristic San Francisco tram station, an orbital drydock above the city, a Federation monitor station far out in space, a remarkable space office complex, the interior of a Klingon cruiser, the mysterious enemy, and numerous spacecraft.

"The problem was to show an era so far in the future, and yet stay ahead of today's technology," Michelson says. "We could let our imaginations run wild. But, producer Gene Roddenberry and director Robert Wise insisted that whatever we designed and built must be completely believable to audiences. They also insisted that we use materials, furnishings, whatever, that didn't look like anything known today.

"It was a helluva challenge!"

What it meant was that everything for the film "Star Trek — The Motion Pic-

Science officer Mr Spock at his station on the Star Ship "Enterprise".



The crew of the "Enterprise" crowd onto the recreation deck to be briefed on their perilious mission.

ture", from set construction to furniture to props and various gadgets and instruments, had to be designed and made from scratch. There was no store or warehouse where Michelson and his crew could buy finished products. Nor were there any old sets stored away at Paramount that could be utilised.

The most familiar set to "Star Trek" fans is the circular bridge of the "Enterprise", with science, communications, security and other stations spaced around its perimeter. From his seat near the centre, Captain Kirk (Shatner) gives his commands.

"We know this set had to be recognisable, otherwise those fans wouldn't accept it," Michelson declares. "Yet, we also knew we had to give it the look of a big motion picture, the quality and detail it couldn't have within the limitations of television."

In the event, the bridge was built up from a number of sections, welded together so that filming could take place from inside the set. A ceiling, adapted from the end of a jet engine, was added, together with instruments and lighting that allowed crew

The alien invader, hurtling towards Earth at "warp seven" speed.

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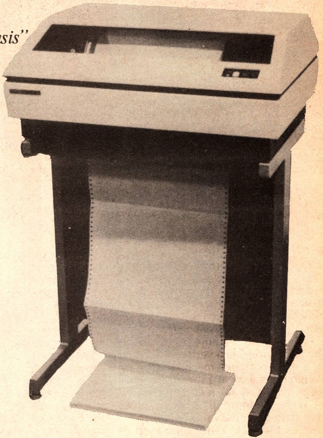

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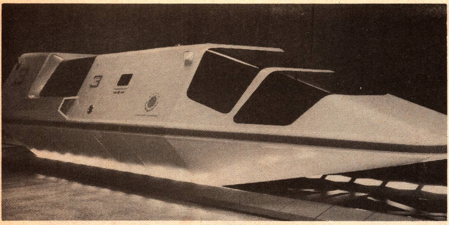
Star Trek: defending Earth from the aliens



Above: Star Planet Command air tram — part of a futuristic San Francisco tram station. Right: Mr Spock prepares to venture outside the "Enterprise" for a "walk" in space.

members to be lit individually. All of the spaceship's interiors, including the bridge, engineering deck, medical centre and transporter room were built life-size, so that audiences could examine the intricate sections of the giant craft.

According to Paramount Pictures: "The 'Enterprise' is a veritable floating city, a dazzling space machine bursting through the galaxy at a speed 218 times that of light. It is 947 feet long and 417 feet wide — more than three times larger than a football field".

What's that? 218 times the speed of light? . . . whatever happened to Albert Einstein and his theory that nothing can travel faster than the speed of light?

It seems that the spaceship "Enterprise" gets around this limitation by using an old-science-fiction device: warping space to form a connection through "superspace", thus making its own little universe outside our normal spacetime! It's all made possible by the "Enterprise's" matter/antimatter annihilation propulsion system, says Paramount.

The instruments and graphics at each of the stations, and throughout the "Enterprise", were meticulously designed. Everything had to work, and each cast member was required to learn how to use the complex instruments on the panels and to know the coding of the various flashing lights, signals and screens.

The way in which the computer graphics displays were made visible on the many bridge console screens was simple, yet ingenious. First, the displays were designed and programmed on a microcomputer system, then filmed directly off the screen of the monitor as they ran. The resulting 8mm and 16mm film loops were then rear projected onto the various console screens on the bridge of the starship.

According to Michelson, the outside of the bridge, the part not seen by the audiences, was almost as interesting as the interior. It was covered with hundred of kilometres of wire for the instruments, panels, lights, and other special effects equipment. The suggested length of wire used? . . . around 650km!

Designing the chairs on the bridge, particularly that used by Captain Kirk, was another imaginative achievement. They were shaped to the human spinal column.

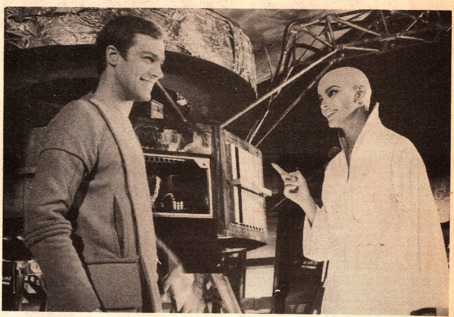
"They have radiating nerve endings, giving the impression that there is something magical in the chairs that would massage or relieve any pain," Michelson explains. "After all, 300 years from now, you could have a remarkable chair.

"During combat, the arms fold in a clasp around the person like an automobile seat belt. The back rest would pop up and completely encircle and secure the person. We installed motors to make the arms clamp down."

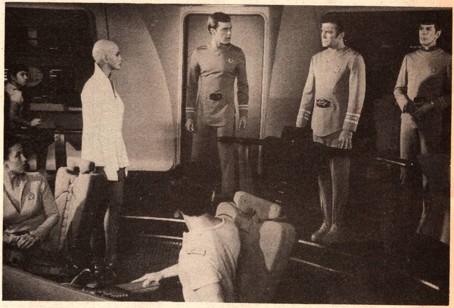
In addition to the various sets, the special effects men also had to come up with an array of futuristic technical gadgetry. Included here were such items as phasor guns, photon

Left: Captain Kirk and Spock look in as Ilia, the new navigator of the "Enterprise", undergoes a full body scan in Dr McCoy's sick-bay.

Star Trek: a $20 million science fantasy



Executive Officer Williard Decker and Ilia with an early "Voyager" spaceship.



Ilia, Decker, Kirk and Spock on the bridge of the Star Ship "Enterprise".

torpedoes, wrist communicators, space suits, and various shuttle craft. Among the groups furnishing advice on the film was the National Aeronautics and Space Administration (NASA).

Then there was a monumental task of designing and manufacturing more than 700 costumes. Among these were the new uniforms for the "Enterprise" crew and the native robes and gowns of the many aliens created for scenes in the film. Special costumes were created for the inhabitants of far-flung worlds: Vulcans, Deltans, Klingons, Rigellians, Andorians, Acturians, Betelgeusians, Saurians, and others.

Michelson has this to say about some of the other sets that will be familiar to fans of the "Star Trek" TV series in "Star Trek — The Motion Picture":

"We believe they'll all be recognisable, yet fans will also be aware of the changes and I think will approve of them.

"The transporter room, we decided, should give viewers the feeling they are inside a fantastic machine. After all, the idea of transporting people by breaking them into molecules and sending them off someplace is fantastic. We got rid of some of the earlier gaudy colours. Between the transporter, which is virtually unchanged, and the console where the Transporter Chief is stationed behind glass, we covered the entire floor with vacuum-moulded pipes and wires, and covered that with see-through grating.

"The engine room is greatly expanded. We wanted a feeling of tremendous power, but not with the colouring of fire as we would get today. So we went to different shades of blue going to white. The vertical core, now two and a half stories high, and the horizontal part of the engine, appearing to go off into infinity, were all newly designed and made of plexiglass. To make room for the horizontal section, we broke through the end of the set and, using forced perspective, gave the exaggerated impression of its length.

"The Sickbay, very hospital-white, has its specially-designed beds built on one post to appear floating. The beds were made of fibreglass, and wired for lighting. Monitors behind each measure the temperature, blood pressure, etc, of the patient."

The medical quarters start with McCoy's office and laboratory, and continue with the examining room. The latter features a transparent table containing a skeleton of the human body. It gives an eerie feeling, particularly when the Deltan Ilia (Persis Khambatta) is examined on it and a laser beam traces her body on a screen above the bed.

Among new sets conceived for the film was the three-story tall Recreation Deck, where more than 300 players represent much of the previously unseen 431-person crew of the "Enterprise" in a scene when Captain Kirk briefs them on the dangerous mission ahead.

"We decided to place it in the saucer of the ship, facing the rear," Michelson explains. "Thus, we could have big windows at one end to look out on other parts of the craft and, by a huge, painted backing, show the orbital dock holding the Enterprise during its refitting. In this way, viewers can tell where we are and get an idea of the space beyond.

"It meant cutting holes in the wing of the 'Enterprise' model to make the exterior match this interior set."

We'll let Paramount Pictures have the final say: "For the hundreds of artisans involved — actors, technicians, production co-ordinators — 'Star Trek — The Motion Picture' has meant three years of bringing to cinematic life that which has never before been seen on the screen. The goal: to dazzle the senses, to make the visions soar, to make possible that journey to the second star to the right".

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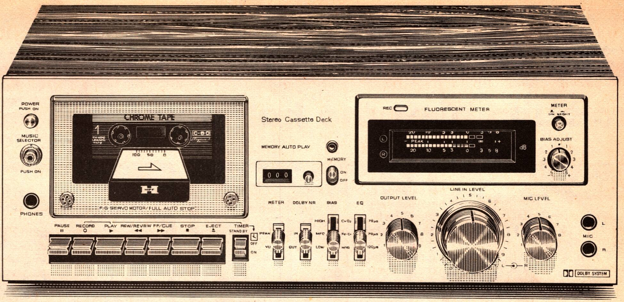

see footnote

When choosing a cassette deck . . .

WHICH FEATURES

Do I really need?

The cassette-deck market is getting to be a jungle in which all sorts of technical fauna roam, screaming their characteristic cries — "metalready," "sen-dust," "peak-hold", and so on — in cacophonous chorus. Even the veteran stalker of such game may become bewildered; the neophyte sorely needs a guide. And, herewith, we present the kind of assistance that would seem to be appropriate to the situation.

by ROBERT LONG*

Let's begin with a feature whose cries are particularly strident (and often misleading) at present: the level indicator. Signal evaluation is critical to the process of getting the best possible recording, and there is wide divergency in the sort of information that different types of indicators will give you. Meters are the "classic" provision, and even they diverge a good deal.

VU OR AVERAGING METERS: If a deck claims "professional VU meters", be cautious about the phrase. What's good for the professional doesn't necessarily serve amateur interests, and not all so-called VU meters really are; they will be averaging meters, though not necessarily with the carefully defined "ballistics" of true VU design. By definition, an averaging meter will not read instantaneous peaks, which must be allowed for in evaluating their indications.

Typical practice might put their "0VU" indication about 6dB below the actual midrange overload point of the tape on the theory that instantaneous peaks may run about 6dB higher than the averages shown by the meter. On signals that have been compressed, as are many FM broadcasts, the actual peak-to-average ratio may be much lower; on live music they usually run to 10dB or more. Thus if you slavishly follow the indications of an averaging meter — even a good one — you can be wasting some of the tape's dynamic range in recording from FM while getting distorted transients on Aunt Jennifer's piano playing!

LEDs, PEAK READING METERS: For amateur purposes, I'm convinced that peak readings are more useful. Some decks with averaging meters also include a peak-reading LED (or a pair-one for each channel) that fires near the tape-overload point. This is a help, though it requires you to watch two indicators — the meters for general program level (and/or any test tones used in setup), the LED(s) for peaks and transients. So-called peak-reading meters substantially combine both functions. Their meter-drive circuits "hold onto" maximum instantaneous values long enough for you to read them; that is, they are driven quickly to the peak value and then eased back down so that the needle action isn't too swift to be visible.

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*Robert Long is Audio-Video Editor of "High Fidelity" magazine. The article has been reproduced by arrangement.

LEAD ILLUSTRATION: We took a fancy to this line drawing, which was issued by Technics, when publicising their then-new bar-graph level indicators. We deleted the brand name purely to avoid any suggestion of partiality.

Level meters or LEDs? — bar graphs — range & frequency

"BAR GRAPH" LEVEL INDICATORS: The latest enthusiasm among deck designers is for liquid-crystal, fluorescent, or other displays — including rows of LEDs — of the type often called "bar-graph" level indicators. Usually they're arranged in two horizontal stripes so that the left channel is represented immediately above the right. You really can see both at once with this scheme, whereas you can't with the typical dual-meter setup.

In many, the portion of the "bar" that extends beyond the "zero" indication lights up in red or otherwise calls attention to itself when the signal exceeds the reference level, so the warning can be glimpsed even out of the corner of your eye. Some can be set to retain the highest value reached — either for a short time or until you reset the indicator manually — so that in copying a record or tape you can easily determine what the maximum level on it is and how you should adjust your deck to accommodate it.

All this is to the good, but bar-graph indicators can have drawbacks. Some, for example, are too sparsely calibrated in the critical 0dB range, where their discrete indications should be no more than 1dB apart. Don't be fooled by what appear to be separate elements in the bar, dividing it into 1- or ½-dB steps; they may light by twos or threes and hence only resolve steps as wide as 3dB in this range. Also look at the way the display "pulls back" when the signal is removed. If the bar suddenly disappears — or even retracts very quickly toward the left — it will be very difficult to read signal values in swiftly changing dynamics. Look for a display that jumps over to its full indication but returns rather sluggishly to lower readings. And look for one that does not require concentrated watching to catch the moments when it advances into the over-zero range.

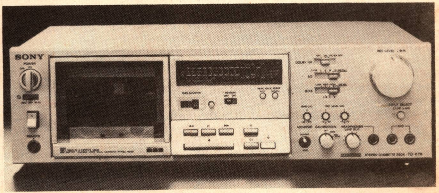
RANGE OF INDICATION: Whether the signal indicators are bar graphs, LED displays, or conventional meters, check the calibration range. Some go down to only -20 or so, giving you no useful measure of what's happening in low-level signals. I prefer being able to read values to about -40. If you do much live recording, this ability can be important, since signals that still don't read on the indicators are down near the noise and would profit from gain riding. On the other end, useful calibration to at least +6 (again, preferably in 1dB steps) is desirable, since the headroom of cassette tapes is being improved all the time and, without matching headroom in the meters, you can't make best use of the tapes.

EFFECT OF FREQUENCY ON METERING: Even so, there is the question of the spectral demands the music places on the overload curve of the tape. No tape will accommodate as high a level at 8kHz as it will at 800Hz — nor should it, considering the typical spectral distribution of energy in music, which is what the tape/recorder system is engineered for. This means, however, that abnormally high energy levels toward the frequency extremes can overload the tape even when the indicator says that the music shouldn't.

Some deck manufacturers meter the signal after it has received its recording equalisation (pre-emphasis) and consequently come much closer to telling you how signal levels relate to the overload curve even when their spectral distribution is a typical. Another approach (first adopted by JVC) is to give you, in effect, a simplified real-time spectrum analyser that will read separate frequency bands independently to help you judge signal demands relative to tape capability. To make full use of these sophisticated approaches, you must have a fairly detailed understanding of how a particular tape's capability relates to the display device at hand. This may be a bit much for many amateur recordists to assimilate, and for them a good peak-reading, pre-equalisation meter's straightforwardness is hard to beat.

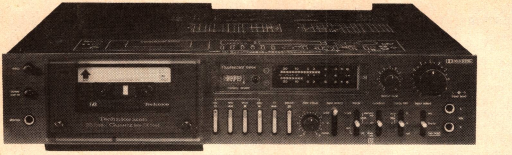
HEAD MATERIALS: A great deal of fuss has been made over head materials, particularly since the announcement of the metal-particle tapes, which make extra demands on head design. Cases can be made for the superiority of this

◀ *Nakamichi broke new ground with their model 680, which has provision for metal tape but is also capable of operating at half-speed. (See our September issue, page 41). In addition, it has provision for Dolby noise reduction as well as the new High Com II anti-noise system foreshadowed by Robert Long. Other aspects of the design are equally modern. (Convoy International Pty Ltd, 4 Dowling St, Woolloomooloo, NSW 2011).*

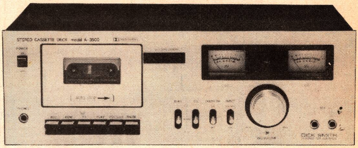


Sony describe their new TC-D75 (right) as "one of the best stereo cassette decks that Sony has ever produced". It features a 3-head system, with record and playback heads sharing the one tiny, but carefully shielded housing. It provides four settings for bias and four for equalisation, including provision for metal tape, with calibration facilities built in. The transport system uses twin capstans, level is indicated by a multi-colour bar-graph and controls are feather touch. (Sony Aust. Pty Ltd, 453 Kent St, Sydney, 2000).

How many heads and in what form? One capstan or two?



Technics are justifably proud of their RS-M85 deck, which features a quartz-locked direct drive capstan motor to give a very low wow and flutter figure of 0.035%. A second motor is used for reel drive. The deck also features IC logic for feather-touch control, SX (Sendust Extra) R/P head, fluorescent bar-graph level indicators, and a response to 18kHz, with Cr02 and FeCr tape. (National Panasonic Aust. Pty Ltd, 57 Anzac Pde, Kensington 2033).



The A-3500 deck (below) marketed by Dick Smith Electronics is of modest design but sells at a modest price: $159. It features normal tape control facilities, three bias and equalisation settings, mic. and line input, and phone jack. In a recent review by Louis Challis/ETI, it was rated as unusually good for the price.

or that head material or design in this or that respect; we prefer to approach the question on a "black box" basis, examining results rather than means. If, for example, permalloy heads are to be chosen over ferrite for their superior saturation headroom, the headroom of the electronics must be comparable; superior head performance means nothing if the limiting factor is elsewhere in the total system.

TWO HEADS vs THREE: More important to practical operation (and sometimes to performance) is the type and placement of the heads. There is a lot to be said for the conventional two-head design in which a combination record/play head occupies the centre opening in the cassette shell, opposite its pressure pad. Response of the best designs is very good, and they avoid the mechanical complications that characterise three-head design. Some designers feel, however, that the extra high-frequency performance that can be eked out of a separate playback head is worth coping with the complications. And of course you cannot have simultaneous recording and playback off the tape — the so-called monitoring capability — without separate heads or head elements.

TWO HEADS IN ONE HOUSING: Some monitoring decks employ, in effect, two heads in a single housing, located in the same shell window occupied by the combination head. Thus much of the mechanical simplicity is retained and combined with the tailored gap widths (wider for recording than for playback) of separate heads. The two-in-one heads don't allow you to cue up a tape to the precise spot where you want to begin recording — a capability that's available only with an integral R/P head and important only if you want to do tight "electronic editing" via the pause control. Two-in-one heads also tend to suffer more from the so-called contour effect (otherwise known as "head bumps") that introduce some response roughness into the bass and lower midrange. And if the shielding between the recording and playback elements is not very efficient, some of the recording signal can induce output at the playback head; while the sonic results may be a bit odd during tape monitoring, the leakage does not affect either the recording or subsequent playback of it.

SEPARATE RECORD AND PLAY HEADS: Some three-head decks use completely separate recording and playback heads. They may be placed so close together that (like the two-in-one designs) they can share the cassette pressure pad in the central opening. Sometimes one head or the other is moved to another shell opening. This allows more leeway in design (for instance, to increase the size of the playback head for minimum contour effect), but it also puts a premium on tape tensioning for good tape contact on the head that is away from the pressure pad. And it allows more opportunity for the tape to wiggle and skew between the two heads, changing its effective azimuth. This is why some three-head decks have a user-adjustable recording-head azimuth — to give you recordings that, whatever skew tendency a particular cassette may have, will match the azimuth of the factory-set (and prerecorded-tape-compatible) playback head.

TWO CAPSTANS FOR TWO REASONS: A closed-loop double-capstan drive is one way to control tape tension. The closed loop can, in fact, increase performance (especially in the left channel, which lies at the edge of the tape and therefore is subject to greater mechanical vagaries than the right) in any deck.

Double capstans can be used for another purpose, however: bidirectional drive, in which they are not used simultaneously for closed-loop control of tape motion. The ability to reverse drive direction, which is often coupled with automatic reverse or continuous play, has obvious practical advantages for hands-off continuity. But be warned that, even if you use leaderless tapes, there will be some break between cassette sides and that, if you rely on the auto reverse during the recording to get uninterrupted music, the hiatus may fall more awkwardly than if you had made the side-switch manually at an intelligently chosen moment. And bidirectional systems tend to be more complex (and therefore more expensive and, potentially, trouble-prone) than unidirectional ones.

ONE, TWO OR THREE MOTORS?: A great deal has been written about the virtues of two motors (one driving the tape via the capstan, the other to wind the cassette hubs) over

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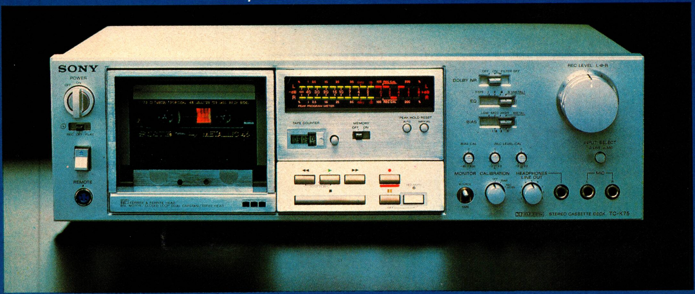

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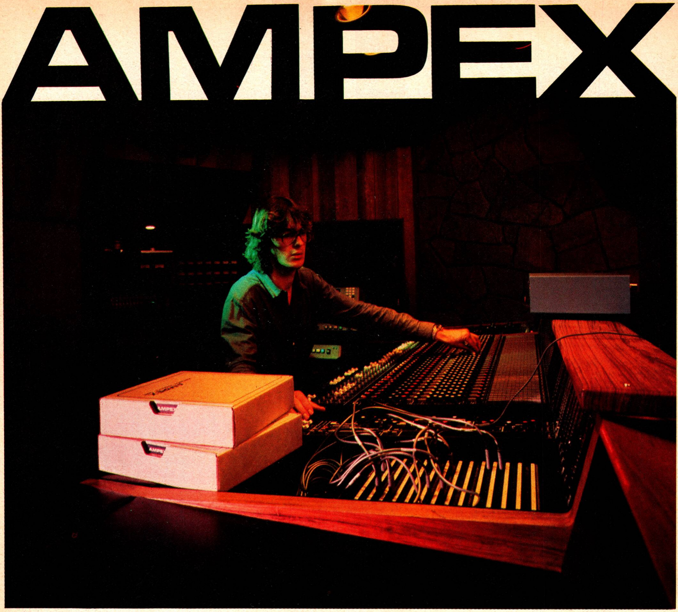

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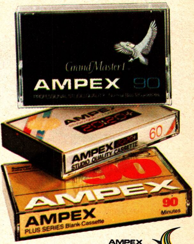
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How many speeds? — Coping with bias and equalisation

one that must do all the work via a series of belts and pulleys and clutches. Some decks use a third motor, whether for a special purpose (eg, the "logic cam" motor on the Nakamichi 582) or to give each hub its own.

Similarly, there are conflicting claims about direct capstan drive systems — with or without servo controls — and how they compare to the conventional belts. Here again, the proof of the drive system (including any special antiwow inertial design) is in the using and/or the measuring. Fine results can be achieved with fairly old-fashioned technology; the newest wrinkle doesn't guarantee the best performance. You're best advised to buy by the specs and/or test results.

ONE, TWO OR THREE SPEEDS?: Until recently, all available cassette equipment ran at a single speed: 4.8cm/sec. Then BIC (followed by others) announced that it would sell a two-speed deck offering 9.5cm/sec as well. Recently Marantz unveiled prototypes of a whole new line that included 4.8 and 9.5cm/sec in the home decks, 4.8 and 2.4cm/sec in some portables. At least three companies appear to be experimenting with 2.4cm/sec as a serious medium (with premium tapes) for home recording, so high-quality three-speed home decks may well be announced in the near future. Obviously 4.8cm/sec is an indispensible speed: The whole format, including tape formulations, has been engineered for it.

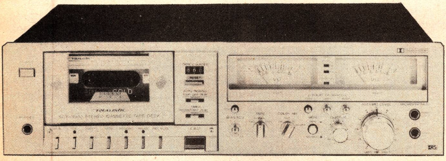
Suffice it to say here that the higher speed offers a performance edge (arguably even with medium-priced tapes and in comparison to 4.8cm/sec used with the most expensive) but at the price of half the playing times per cassette side. The slowest speed obviously will entail some compromises — particularly in high-frequency response and distortion — but, with careful deck design and choice of tapes, the tradeoffs may be so minor that you can still get good results with average-quality signals. And there are advantages: lower tape cost than with 4.8cm/sec (depending on how much more "premium" the tape must be for acceptable results at the lower speed), less print-through (if what would have been recorded on a C-90 is recorded on the thicker-based C-45 equivalent), and double playing times (for the same cassette length used at both speeds).

EQUALISATION AND BIAS SWITCHING: Some decks have separate playback equalisation switches; some combine EQ with bias in a Tape switch; some use automatic sensors to set equalisation. The trouble with the latter is that ferrichromes and the early chrome cassettes (all of which normally are used with the 70-microsecond playback equalisation) don't have the sensor well needed for automatic switching. Now the same thing is happening with metal-particle cassettes: Early samples are without this well (or another that has been proposed for automatic bias adjustment), which may be required by future automatic-switching metal-tape decks. So the knowledgeable recordist who tends to jump into new cassette areas quickly will prefer separate manual EQ switching for greatest leeway in working with what eventually may prove to be standard shells, while the casual recordist who moves in only after the dust has cleared may be better off with the automatic feature so he doesn't have to think about switch settings.

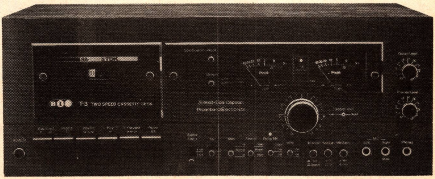
This statement also applies to basic bias adjustments, which are handled (during recording only, of course) automatically by those decks having the sensors. But a wide range of bias settings is needed if you are to make best possible use of the many available tape types and brands. And there is the related question of recording equalisation, which may not be the same for tapes that require the same playback equalisation and must be accommodated somewhere in the bias/EQ adjustment scheme.

So the more limited the scheme, the more limited the tape options or the more imperfect the performance if the tape is not chosen widely to match the options available. This is not altogether bad, especially for the casual or novice recordist; it is a good idea to seek out and stay with brands that give good results with the deck.

ADJUSTABLE AND AUTOMATIC BIAS: The advanced recordist will want to try every "improved" tape as it comes



Tandy have a range of about five cassette decks, from an economy model at $169.95 to the Realistic SCT-3000 pictured at left and priced at $629.95. Tandy describe it as "Our finest ever". An interesting feature is the provision of two complete Dolby systems which, in conjunction with the three-head design, permits thru-Dolby monitoring while recording. Adjustment facilities are inbuilt for Dolby and bias level. Details from any Tandy store.



BIC is one of the few brands which currently offer two speeds: 4.8cm/sec and double speed. There are three models, the T1 (least expensive), the T2 and the top-of-the-line T3, as pictured, right. It has three heads, two motors, and peak indicating meters calibrated from -40dB to +5dB, plus many other features. Guaranteed response is to 19kHz (+,-3dB) at 4.8cm/sec, and to 22kHz at double speed. For details of the BIC range: Quality Hi-Fi, 400 Kent St, Sydney, 2000. Phone (03) 29 1005.

More about bias-setting Dolby levels — types of tape

SIMPLICITY THE KEYNOTE

Characteristic of their basic philosophy, Bang and Olufsen's Beocord 1900 combines a low profile design with a minimum of fuss for the user with Fe/Cr switching, counter, memory off/on and Dolby off/on. Rated response is to 15kHz (DIN), S/N ratio 56dB (DIN, chrome) and 64dB with Dolby. Wow and flutter is +,-0.15%. R/P head is Sendust and the twin meters are peak reading, just prior to the record head. (The GRD Group Pty Ltd, 698 Burke Rd, Camberwell, Vic 3124. Phone 03 82 1256).

along. And he will know that excellent results can be obtained from less-than-premium tapes (as long as they are housed in shells of high mechanical quality) with correct adjustment.

In general, the best sonic quality per dollar comes from the better (but not best) ferric group. Since it is in this group that bias requirements vary most and, in some cases, require the most exact adjustment for good results, some decks offer continuously variable bias settings only for ferrics. In other decks, the bias knob affects all tape settings, which allows you to control more tapes but is more likely to require readjustment each time you switch from a tape in one group to one in another. A few decks allow you to adjust bias independently for each group — the ideal arrangement. In my opinion, for the advanced recordist. Some decks give you "tuners" for recording equalisation instead of bias current, with much the same effect because of the intimate relationship between the two parameters.

Either way, home setup for ideal adjustment is not as easy as it sounds; while good results can be achieved with the single (high) frequency available in the test oscillators provided in such decks, very flat response can be assured only with more elaborate means, such as sweep tones, spectrum analysis, or even careful aural analysis via a three-head monitoring system.

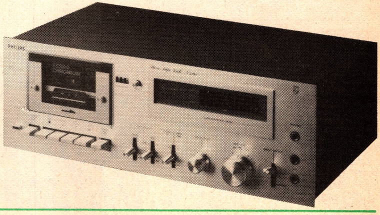
TAPE SENSITIVITY & DOLBY: Since the Dolby noise-reduction circuit is standard in the cassette format and is level-sensitive, best results with it require some adjustment for differences in sensitivity between one tape and another. The simplest decks include sensitivity compensation in their basic tape switching — which, again, puts a premium on sticking with tapes that you know. Others offer what are variously called Dolby Tracking or Calibration or Recording-Level adjustments that are user-accessible. And, again, the novice probably is best advised to go with the simpler scheme on the theory that whatever can be adjusted can inadvertently be left misadjusted. Where user adjustments are provided, I recommend separate adjustments for each tape type (so that you don't have to use them each time you switch from ferric to chrome) unless you're the sort of perfectionist who will tweak every control before beginning every recording.

FOR WHAT KINDS OF TAPE?: In a sense (and although they are relatively insensitive to minor misadjustments of bias), the existence of metal-particle tapes makes all these tuning adjustments all the more important since it's not entirely clear just what direction the metal tapes may take. Metal tape does offer a performance increment to the medium, but it's too early to tell how many recordists will be willing to pay the price for that improvement, how far (if at all) prices can be brought down in the future, whether still greater improvements can be realised with metal (or other) pigments — in short, whether metal tape is the wave of the future or the fad of the present.

Today, the advanced recordist probably will covet the capability, but the casual recordist will approach the relatively expensive decks capable of recording on metal tape with caution, since he will be hard put to tell the difference between it and the chromes. The ability to record on this group (many of which are ferricobalts, rather than chromium dioxides, of course) is surely a must for any high fidelity deck. So is a ferric (normal, standard, low noise, or whatever) setting, in my view — both because of the good cost/performance ratio of the medium-priced ferrics and because the best ferrics usually deliver very fine performance indeed despite the higher noise levels implied by their 120-microsecond play-back equalisation. Some decks also can get excellent performance with ferrichromes, though we generally have found them the least satisfactory tape group on the decks we have tested.

FROM THE CASSETTE PIONEER

Philips, pioneers of the compact cassette, could scarcely have anticipated how popular the format would become — and how far the concept would stray from their original standards. Their own N5391 deck provides for ferric, chromium and metal tape, with Dolby noise reduction and an in-built MPX filter for taping off-air FM. Inputs are for mic and line and the output level is variable. Metering is by means of peak reading fluorescent bar-graphs. Quoted response for metal tape is to 16kHz.



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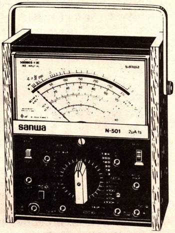

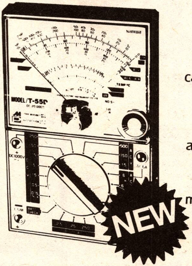

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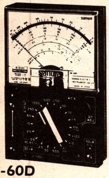

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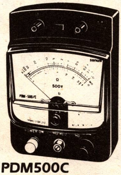

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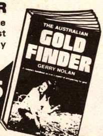

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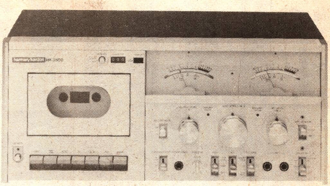


NOISE REDUCTION SYSTEMS: The Dolby circuit may be said to have created the high fidelity cassette deck by chopping 10dB out of inherent tape hiss, and it is required for playback of quality prerecorded tapes.

JVCs ANRS system can also be used for the purpose, since it matches Dolby within close tolerances; in addition, JVC offers what it calls Super ANRS, via a separate switch position that allows somewhat higher recording levels without undue high-frequency distortion.

Teac, among others, has investigated the DBX system as an alternative to Dolby B. While DBX offers greater noise reduction and may be preferrable for live recording, it is incompatible with Dolby tapes — whether prerecorded or in existing libraries.

The most sophisticated noise-reduction system yet proposed for cassettes appears to be one developed by Telefunken (and evidently, adapted by others) from its professional equipment. Nakamichi have adopted their own variant of it, with a claimed improvement in S/N ratio of 20dB, but how many others will follow suit remains to be seen.

TAPING DOLBY-FM BROADCASTS: Some Dolby decks have switches that allow Dolby-encoded signals (from FM or other tapes) to be recorded as is, without decoding and re-encoding to make the new Dolby tape. The switch usually allows you to listen (without recording) to Dolby broadcasts — simply decoding the signal on its way through the deck, with or without the required broadcast de-emphasis change. If your receiver or tuner has a 75/25-microsecond de-emphasis switch, you won't need it in your deck's Dolby-FM feature; otherwise you will, or you will have to add an outboard EQ switch. If your purpose is to record Dolby-FM broadcasts and you can decode the signal before it reaches your deck, you probably are better off taking that tack, since it will restore control over your recording level (which is fixed with the Dolby-FM/copy feature) for best possible results.

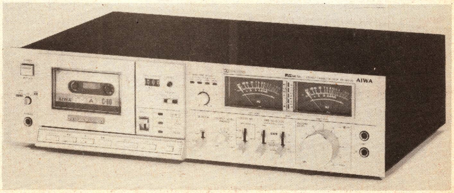
If you intend to copy Dolby open reels, you had better have cassettes with extraordinary headroom plus a lot of luck, since open-reel peaks can easily go more than 10dB above Dolby reference level and cassette tapes usually can manage no more than about 5dB in the midrange and much less in the highs before overload sets in. Decoding and recoding are strongly advised.

FM-STEREO "MPX" FILTERS: Dolby Laboratories licenses its noise-reduction circuit to deck manufacturers on the express condition that a filter be included to prevent the 19kHz stereo (multiplex) FM pilot from arriving at the encoder in sufficient quantity to inhibit correct operation even though few quality tuners or receivers have anything like that much pilot in their output signals. The less expensive decks comply by building in fixed 19kHz filters; the more expensive ones usually allow you to switch out the filter for the most extended possible high-frequency response. There seldom is much audible difference, but sometimes (particularly on midpriced decks) the high-frequency performance is cleaner with the filter in, because it inhibits inter-modulation "birdies" even when no pilot is present. In such decks, you're better off using the filter.

MICROPHONE & HEADPHONE FACILITIES: If you do live recording, you may want mike/line mixing so that, for example, you can sing along with a prerecorded accompaniment. But if a deck you admire otherwise doesn't have it, you always can add it via an outboard mixer. You should have a headphone level control, however, since it implies an extra stage of amplification before the headphone jack to drive the phones loud enough to override ambient sound — a necessity if you're to sit anywhere near the sound source and still evaluate the signals you're recording. But it's not a common feature, and you may have to use a separate amplifier if you want to do serious monitoring during live recording. Many decks do have overall output level controls; even at their maximum, they may not drive headphones really loud and seldom could be considered a necessity, but they help to tailor signal levels from the deck to those delivered by other components in the stereo system.

AIWA MODEL AD-M700

AIWA claims to be the first company to have exploited the hifi/stereo potential of the compact cassette. They're still doing it very well, as evidenced by this new model, with full 3-head facilities and double Dolby circuitry. Particular attention is paid to the bias and eq. requirements of all tapes, including metal; also to level metering with a 52dB range. (AIWA Aust Pty Ltd, 14 Gertrude St, Arncliffe, NSW 2205. Tel 02 597 2388).



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A round-up of other facilities — a final word of advice

MUTE, FADE, PAUSE FACILITIES: A nice detail of some recent decks, especially for off-the-air recordists, is the recording mute, which can be cut in at the end of your recording to leave a patch of silence before you press Pause and get ready to record the next selection. Sometimes the Mute is integrated with the Pause. As an alternative, some decks offer a fade feature so that, even if you don't hit Pause at the precise instant between the end of the music and the beginning of an announcement (an instant that may be filled with applause on a live broadcast anyway), you still will get a graceful sequence. Some fades can be used on previous recordings to sponge away unwanted material at the end.

But the most important feature for graceful beginnings and endings of your recordings is the almost universal Pause. If it will start and stop instantly without leaving aural clues (pops, silence, wows, or whatever) to its use, it is a tool by which you actually can edit music, even in the middle of a phrase, in copying from disc or tape. A slow-acting pause, which may take as much as a second or two to get up to speed, still is very useful in editing between selections or other program elements where there are breathing spaces to stop and start in. If the Pause has a built-in undefeatable mute, it usually is not better than regular start-and-stop operation for editing; if it leaves audible noise (such as a pop) on the tape, it may be worse.

SEARCH & CUE, MEMORIES, ETC: Sometimes the Pause or other controls combine with the fast-wind modes to allow partial audibility of the program on the fast-moving tapes as a genuine aid to locating the spot you want. A few decks have microprocessor-controlled systems that hunt for, and stop at, the spaces between selections, usually with a programming control of some sort. This kind of deck may also have a display that reads out actual playing times instead of the arbitrary numbers that appear on the much more common "turns counters". But such counters can be fitted with "memory" systems that will stop the tape (sometimes in Rewind only, sometimes in Fast Forward as well) when the zero reading is reached, and some memory rewinds can be switched to recommence Play automatically when this happens, while some others will automatically do so unless you also press Pause during the rewind. All of these features can be conveniences, though their importance depends largely on the sort of uses to which you regularly put a cassette deck.

SOLENOID, TIMERS, REMOTE CONTROL: The main transport controls can be mechanical levers (which are cheaper) or switches — often capacitative contact switches — that control solenoids, which do the real work (and are more elegant of feel). While some differences in practical behaviour are implied, careful design can imbue either with most of the virtues of the other, so neither has a pre-emptive advantage.

Solenoid controls make it easier for the designer to fit the deck with automatic-timer operation so you can use it as an alarm clock, record FM programs when you're away from home, and so on — a useful feature for many recordists. And they're almost obligatory for full-function remote operation, whether via an umbilically connected control unit or via one of the cordless accessories (infrared, ultrasonic, etc) that seem to be growing in popularity.

Hands-on (or, rather, eyes-on) recordists who feel lost if they don't know exactly what the meters are doing may consider such remote controls virtually useless (unless they want to tape their own performances); armchair recordists may consider a remote a godsend.

Although promoted as a medium-price deck, Pioneer's CT-F750 provides auto reverse, settings for four types of tape (incl. metal), record mute, separate line/aux level controls, and bar-graph level indicators switchable for peak or average reading. (Details from Pioneer Electronics Aust Pty Ltd, 178-184 Boundary Rd, Braeside Vic 3195. Tel. 03 90 9011).

SEE ALSO:
The JVC KD-A8 reviewed on page 36
The TEAC A-430 reviewed on page 39

LIMITERS AND ALC: If you make recordings of yourself — or any other live source whose levels are subject to changes that you may not be able to correct for at the deck — you should consider some sort of automatic level control, which may be called an ALC or a limiter without any particular regard for the technical difference between the two. A true limiter severely compresses all signals above its operating threshold, so that they never have a chance to reach the tape's overload level, but leaves lower levels unaltered. The result can be very mushy climaxes unless the levels are so cannily preset that you don't really need the limiter anyway. An ALC, as I would define it, quickly reduces overall gain whenever signal levels threaten overload and then slowly creeps them back up until they are once more bumped down by a new peak. The effect generally is much more natural, though widely varying signal levels can cause audible fluctuations in any constant background noise as the gain goes up and down. The only real way to tell what a feature of this sort does, however, is to try it.

SPEED CONTROL: And if you do live recording, you may be interested in one last feature: a pitch adjustment. It will allow you to record one part with the assurance that you can always tune it to whatever instrument may subsequently play along with it, even if the deck's transport speed is subject to variation with line voltage. The control also will let you correct (within reason) recordings made on off-speed portables. But be sure the deck gives you some way of getting back to correct speed when you want to.

SUMMING UP: Obviously a great deal of the trick in buying features is to be realistic (and honest, which isn't always so easy) about what you will need and really use — about why you really want the deck in the first place. Don't be afraid to admit it if you're in love with a brand name or an array of switches; until you do, you're in danger of buying the wrong deck for the wrong reason. On the other hand, "It would be nice to have" is poor motivation by comparison with "I'll be able to hear the difference." So sort out your priorities carefully; your money and your years of enjoyment or disappointment are at stake.

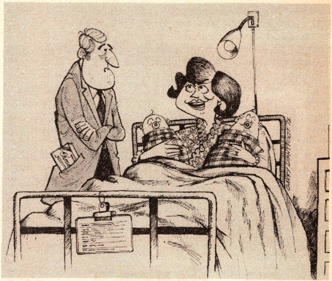
FORUM

Conducted by Neville Williams

NEW ZEALAND HAS LOTS GOING FOR IT

. . . but no FM/multiplex!

With FM/stereo rapidly becoming just part of the everyday scene in Australian broadcasting, we may need to be reminded that it isn't that way in New Zealand. Hifi enthusiasts over there are still pouding on the doors of Parliament, waiting in vain for some kind of positive response.



"You've always been keen on stereo reproduction!"

Amongst those whose fists have been bloodied into pulp by pounding on the panels is reader Keith Macdonald of Silverstream, New Zealand. We must be careful about the surname, because our inadvertant use of the alternative (?) form "McD" in recent correspondence evoked the comment "You sassenachs were never very good at spelling Scots names!"

One must, of course, deplore the introduction of racism into these columns. Those of us whose veins are not filled with tartan-checkered highland blood are . . . sassenachs!

But when it comes to putting hammer to ribbon, K. Macd. is no dour Scot. In stating his point of view about the needs of New Zealand listeners and the attitude of New Zealand authorities, he would have had no trouble to fully occupy the "Forum" pages in any given issue and to carry right on through "HiFi Topics" to "Letters To The Editor", at the back.

But, in response to our sassenach plea "Come orf it mate", he managed to condense his thoughts into the epistle which appeared last month under "Letters to the Editor". There's a good chance that you will have read it.

I have in front of me a yet further letter presumably intended for "Forum" but very similar in content to the one just published. Rather than print it all again, let me quote or paraphrase sufficient from it to recapture the theme:

We have entered a new decade and New Zealand still does not have an FM/stereo service. Because of Government involvement in broadcasting, we are unlikely to have one in the next five years. Yet estimates have put the number of FM receivers in the country as high as 300,000.

Aggravating the problem is the fact that the Government Department entrusted with administration of the frequency spectrum (the NZ Post Office) has allocated all but 4MHz of the international FM/stereo band for two-way radio. This now serves as an excuse, inhibiting either Government or private initiative, even though the Post Office admitted in 1969 that 4MHz would be adequate for a "pilot" service.

They also use the excuse of "no public demand". Seemingly, it is up to the public, who do not understand FM, to convince the authorities as to the merits of the system! Yet it is the same public which is being deprived of cultural broadcasts to make room for sport, particularly during the summer months.

For sure, there is a financial crisis but private operators are prepared to get on with the job. Alas, if private enterprise made it look too simple, the Government might "lose face"!

In discussing the Australian "go ahead" at the time, you suggested that it might strengthen the case in for FM/stereo in New Zealand.

No such luck!

As will be apparent to those of us who have been around for a while, the sentiments, the arguments and the frustrations expressed by Keith Macdonald mirror what was being said in Australia a few years back. The stage was larger, the cast was more diverse, but the lines were much the same!

There was loud complaint about the inadequacy of AM transmissions in an era when so many Australians had demonstrated their interest in hifi-stereo by purchasing systems, records and tapes in huge numbers.

There was the oft-repeated scenario of all these people plus many others, listening contentedly to the new big, wide, off-air stereo sound, free from noise and interference.

The Government of the day didn't enjoy this very much; it posed too many potential problems, much as it still does in New Zealand. Its proper place was in the "too hard" basket.

The multiplicity of privately owned AM stations weren't too keen about it either; it posed a potential threat, over and above the then devastating competition from television.

We might still have been back where New Zealand still is, had the matter remained one of polite debate and formal application to be processed through departments to Government, in the fullness of time.

But the K. Macd's of Australia managed to translate FM from a case to a cause, which was fortuitously taken up by a new government, anxious to be seen to be up and doing. The Government listened to those who were doing all the stirring and commissioned an inquiry by an acknowledged expert whose findings were, to many observers, predictable!

Since then, the wheels of government have been grinding away slowly, with ABC, Public and Educational FM stations emerging at various times and places, along with a sprinkling of new AM stations. As it happens, the licences for the first wave of commercial FM broadcasters have just been issued, with an on-air target date of mid-year.

One can hardly say, however, that it has all happened as part of some precise and detailed plan.

A changed philosophy it undoubtedly is, based on receptiveness and flexibility rather than the rigid refusal. For that we must be grateful. But who gets frequencies, where, when and what for, is still subject to the pragmatics of channel availability and the good old stir-and-lobby technique!

If these observations find a parallel across the Tasman, the clear implication is that the champions of FM/stereo are not going to get very far by presenting logical articles to tea-drinking bureaucrats, or even by writing long, formal letters to the press. What they need are some headlines to grab public attention and somebody in Parliament to take up their cause — for whatever reason.

What about a Brisbane style street march? Or a Sydney style picket line? Or a Melbourne style wharf fracas? Or a square full of Perth style cockies to pelt a politician?

Or an Adelaide art happening?

THAT'S AN IDEA!

Maybe New Zealand needs a change of Government. Australia could easily spare a planeload or two of out-of-work ocker politicians. They'd pick up headlines anywhere!

But, in the meantime, Keith Macd. would be shocked by the way his cause celebre has receded from public attention in Australia. To be sure, the FM inquiry has rated a few headlines in recent months but the headlines are not about FM — the technology. They're about personalities who are seeking the licences, about tactics, about involvement of the media, about target audiences, attitudes of tribunal members, and so on.

FM, AM or any other "M" is largely incidental.

The most recent survey has indicated a total rating figure of 2.4% for the three FM/stereo stations operating for the survey period in the Sydney area. This, despite another estimate which put the availability of FM facilities at between 75% and 80% of all homes in the Sydney and Melbourne listening areas: facilities from full-scale hifi to cheapie portables.

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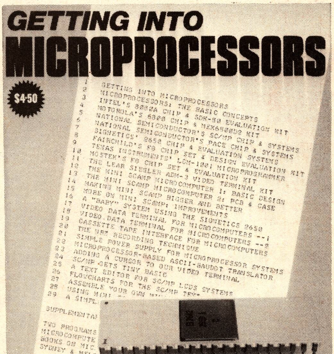
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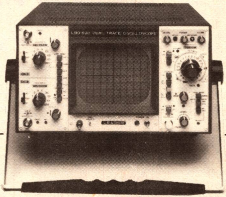

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FORUM CONT: But no FM/multiplex

The figure of 2.4% is up on an earlier estimate of 1.6% but as surveys go, it still represents a tiny 0.8% per FM station — and sufficient only to support them at a meagre level, at this stage in their history.

What about receiving equipment?

For the two classical music stations, the audience would undoubtedly be dedicated, be equipped with full stereo, and appreciative of the quality available from FM broadcasting.

The remaining station has a middle of the road, adult format and an audience which is more likely, on average, to be using an AM/FM portable or car radio, in most cases mono. In terms of equipment, it is probably fairly close to the audience which will be attracted by the commercial stations due on air later this year.

I imagine that much the same will apply to the audience for Sydney's fourth FM (Educational) station, which is now in operation.

These remarks are made, not in any sense of criticism or mischief, but purely to underscore the situation that exists in Sydney towards the close of 1979.

The availability of FM/stereo broadcasts has not triggered a massive swing of quality-starved listeners to the sources of beautiful, wide, noise-free stereo music. Only a very small percentage have been lured to the FM band and maybe less than half of them have equipment which will show it to advantage. The remainder are attracted primarily by the program content — Sinatra, Sousa or Sibelius on a single small speaker!

A reason why FM may not be "news" in Sydney could be that residents already have more than their share of radio and television, with about 13 AM stations and 4 TV stations, not counting signals from nearby country areas. What's a few more on the what-do-yer-call-it band?

When the 33 applicants lined up for the capital city FM licences, each one knew beforehand that they would have to mount a massive publicity campaign to attract a viable audience away from AM — somewhere between five and 10% per station.

Looking over the successful applicants, one might even conclude that the Tribunal was influenced by their potential to generate publicity and to get the FM band moving.

Indeed, the Tribunal is reportedly encouraging successful applicants to coordinate their launch in the various centres, in order to maximise the impact. Only the super-optimists in Australia see FM as an automatic, runaway success, whatever its status in America, Europe, Japan and elsewhere.

What pays station bills is the audience they achieve right here in Australia or (Keith Macdonald hopes) right there in New Zealand.

Getting an FM licence may be quite a battle, the rest of the war comes after that!

Just to round this off, the letter below contains a different reaction to criticism of computers and supports my original contention in the July issue. If hassled, protest — but go to the top says K.L.

Dont remain silent: go to the top!

Dear Sir:

I refer to your article, "An Incredible Coincidence — or Something Else", page 32 November 1979 edition of "Electronics Australia".

As a data processing manager I am very concerned about this and similar stories of "unfriendly", or downright hostile, computer systems.

While it is inevitible that computer systems will sometimes produce inaccurate output, adequate controls should be so designed into each system that errors are found before output is distributed. There are numerous techniques available for controlling data input, processing, files and output and these should be well known to every system designer.

What can the man or woman in the street do when hassled by poorly designed systems?

1. *Call the company senior management (eg managing director, finance director, accounting manager). Give him or her the facts. He or she may be very pleased to receive such feedback from the public as it gives an opportunity to correct a situation that may be costing the company sales or other losses.*
2. *If the response from senior management is negative, find out who are the company's auditors — and give them the facts. The auditors are responsible for certifying the organisation's books of account. They should be prepared to examine systems that repeatedly send inaccurate documents to the public.*

As these shortcomings in systems are overcome, maybe the general community will share in the benefits of computer based systems through receiving faster, more efficient, more accurate and more courteous service.
K.L. (Mount Pleasant, W.A.)

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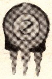

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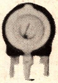
PT 15

PT 15Lv (15)



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Remember: parts for most kits in most of the electronic magazines are normal stock lines. So even if a kit isn't listed, we may be able to help you anyway. Call in and ask us!

FLASH EXPOSURE METER (See EA January)

Printed Circuit Board	Cat H-8371	$2.10
Solar Cell	Cat Z-4820	$2.50

GUITAR PRACTICE AMPLIFIER (See ETI January)

Printed Circuit Board	Cat H 8625	$4.60

PLAYMATE AMPLIFIER (See EA January)

Printed Circuit Board	Cat H-8639	$4.60

TRANSISTOR ASSISTED IGNITION (See EA December)

Complete kit including instructions	Cat K-3300	$32.50
Printed circuit board	Cat H-8367	$2.20
BUX80 power transistor	Cat Z-2150	$10.95

FAN SPEED CONTROL (See EA December)

Short form kit (PCB, components; no h'ware)	Cat K-3090	$11.50
Printed Circuit Board	Cat H-8368	$1.60
SC141D Triac	Cat Z-4510	$1.28

(zippy box, etc, normal stock lines – or build it in to appliance.)

NEW METAL LOCATOR (See EA November)

Complete kit (excluding dowel & former)	Cat K-3504	$19.50
Printed Circuit Board	Cat H-8366	$2.40

INFRA-RED REMOTE CONTROLLER (See EA October)

CQY89A Infra red diodes	Cat Z-3235	$1.50
BPW34 photo transistors	Cat Z-1954	$3.50
Printed circuit boards (pair)	Cat H-8365	$5.95

PROCESS TIMER (See ETI October)

Printed circuit board	Cat H-8623	$3.95

DISCO STROBE Mk 11 (see ETI September)

Complete kit, including instructions	Cat K-3152	$34.50
Printed circuit board	Cat H-8572	$1.95
Flashtube	Cat S-3882	$2.95
Trigger transformer	Cat M-0104	90c
Discharge capacitors (each)	Cat R-2855	$3.75
Reflector	Cat K-6016	$4.50

WINDSCREEN WIPER DELAY (See EA September)

Printed circuit board	Cat H-8364	$2.50

Other components for this project are normal stock lines.

AUTO CHIME (See EA September)

Complete kit	Cat K-3502	$29.75
Printed circuit board	Cat H-8363	$3.70
TMS-1000 Integrated Circuit	Cat Z-6825	$16.50

INDUCTION BALANCE METAL DETECTOR (See ETI)

Short form kit (not inc. dowell or former)	Cat K-3100	$35.50
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MASTHEAD AMPLIFIER (See EA August)

Complete kit	Cat K-3232	$29.50
Printed circuit board	Cat H-8362	$2.50
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5 Elizabeth Street, Mt Gambier SA. Ph 256 404
Keller Electronics
218 Adelaide Street, Maryborough, Qld. Ph 214 559
M & W Electronics
48 McNamara Street, Orange NSW. Ph 626 491
Mellor Enterprises
Shop 2/15 Forsythe St, Whyalla Norrie, SA. Ph 454 131
Power & Sound
147 Argyle Street, Traralgon, Vic. Ph 743 638
Purely Electronics
15 East Street, Rockhampton, Qld. Ph 021058
Stevens Electrical
42 Victoria Street, Mackay, Qld. Ph 511 723
Sumner Electronics
95 Mitchell Street, Bendigo, Vic. Ph 431 977
Sound Components
78 Brisbane Street, Tamworth NSW. Ph 661 363
Trilogy Wholesale Electronics
40 Princes Hwy, Fairy Meadow, Wollongong, NSW. Ph 831 219
Tropical TV Services
249 Fulham Rd, Vincent, Townsville Qld. Ph 791 421
Variety Discounts
113 Horton Street, Port Macquarie NSW. Ph 835 486
Wagga Wholesale Electronics Sales
82 Forsyth Street, Wagga NSW.
Wellington Electrical Services
110 Lee Street, Wellington NSW. Ph 325

COMPUTER CORNER . . .
NEW SORCERER II.

UPGRADED! The BEST is now BETTER!

Yes! The world's best value in home computers has become even better value!
As part of their ongoing research & development, Exidy (the Sorcerer's makers) have made some circuit changes giving the Sorcerer on-board capability of up to 48k RAM plus even greater reliability!
There are a lot of small computers around now – but there is only one Sorcerer.

Sorcerer II (8k RAM) Cat X-3000
$1095.00
Sorcerer II (16k RAM) Cat X-3001
$1250.00

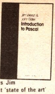
SORCERER USER'S GROUPS

SYDNEY: Meets 1st Friday odd months 2nd Friday even months at 14 Atchison St. St Leonards at 7.30

ADELAIDE: Contact Dr P Delin, c/- Psychology Dept, University of Adelaide, for further details.

For information or contacts in local groups in Melbourne, Ballarat, Canberra, Brisbane, Manilla, Hong Kong, Singapore & Fiji contact the Secretary, Aust. Sorcerer Users Groups, PO Box 43, Peakhurst 2210

'INTRODUCTION TO PASCAL' (Welsh & Elder)



$13.95

'Highly recommended' says Jim Rowe. Pascal is the latest 'state of the art' computer language – if you're a computer enthusiast, this 282 page reference will tell you all you want to know. Cat B-2365

E-X-P-A-N-D IT

To get the most from your computer, you need to put more into it! More memory, that is. Expand your Sorcerer, Apple, TRS-80, etc, with our memory uprgrade kit. 8k to 16k, 16 k to 32k, etc. Compare our prices to theirs!

$149.50

Cat X-1185 for Sorcerer
Cat X-1186 For TRS-80, Apple

PROGRAM TAPES:
Use your home computer to advantage with these tapes:

FOR THE SORCERER:

Magic Maze	(Cat X-3620)	$14.95
PLOT	(Cat X-3621)	$17.95
Z-80 DISASSEMBLER	(Cat X-3622)	$17.95
SHAPE MAKER	(Cat X-3623)	$17.95
DEBUG	(Cat X-3624)	$17.95
FASTGAMMON	(Cat X-3625)	$22.95
YAHTZEE	(Cat X-3600)	$9.95
BALCKJACK	(Cat X-3602)	$9.95
WUMPUS	(Cat X-3604)	$9.95

FOR THE TRS-80:

TIME TREK	(Cat X-3650)	$17.95
STIM. SIMULATIONS	(Cat X-3652)	$17.95
ELECT. PAINTBRUSH	(Cat X-3654)	$17.95
BRIDGE CHALLENGER	(Cat X-3656)	$17.95
MICROCHESS 1.5	(Cat X-3658)	$22.95

COMPARE OUR PRICES WITH THEIRS!

(For fuller description see our adverts last month).

JAMIESON ROWE, Australia's leading expert on home computers, is now with Dick Smith Electronics.

GREAT NEW KITS – TRY ONE!

Transistor assisted ignition kit – saves $$$

$32.50

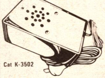
Cat K-3300

CDI IS OUT – TRANSISTOR ASSISTED IGNITION IS IN . . . So says Leo Simpson in December Electronics Aust. Build this simple, yet reliable transistor assisted ignition and start saving your petrol dollars. The transistor assisted ignition has the advantages of the CDI, without the disadvantages.
Our kit includes pre-punced metalwork and the recommended heatsink.

The Autochime: 24 tune doorbell

Here's a doorbell you can build yourself. Just like our built-up version, but you save because you supply the labour. Auto advance to next tune; mains powered. Surprise your friends and neighbours!

$29.75

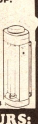


Cat K-3502

Don't want to build it yourself? See the next page for a fully built-up 24 tune doorbell!

DICK LIGHTS UP!

For the camper, in the car, around the home: this 3-way light is brilliant! Has fluoro tube for overall lighting, bright spot for outdoors or a bright orange safety flasher. Outstanding value Cat X-1084



$14.95
Cat X-1084

AMATEURS:

DON'T FORGET: DICK SMITH WILL MATCH ANY OR BETTER ANY GENUINE PRICE (ADVT. IN AUST.) ON YAESU AMATEUR RADIO EQUIPMENT.

PROJECT BUILDING?

Here's the best value in a relay around: on-board mounting, wide operating range (7 to 15 volts) so they're ideal for a variety of circuits, and 200mA contact rating. Great for the junk box: you never know when a relay is going to be needed!

$2.00

Cat S-7120

DICK'S OWN Amateur Radio Handbook

Written especially for AUSTRALIAN conditions, contains loads of info for the amateur and budding amateur.

DICK SMITH'S AUSTRALIAN AMATEUR RADIO HANDBOOK

$6.95

Cat B-2320

6 LEVEL CHESS COMPUTER

Play against a beginner or a master. The chess computer can play at any of 6 levels. Ready for a quick blitz or a slow, thinking game. Comes with bonus chess set. Operates from internal batteries or optional mains adaptor.

Cat X-1250

VALUE!

$99.50 Plus batteries

25-IN-ONE SOLAR EXPERIMENT KIT

Here's value for the budding scientists in the family! Dick's own 25-in-one kit will keep them amused for hours. Safe and educational, too!

Cat K-2032

$16.95 COMPLETELY SAFE!

TRIED IT YET?

The new Yaesu 2 metre hand held with microprocessor control: it's a winner!

Yes, this new Yaesu has to be seen to be believed. A full 2 metre (144-148MHz) hand held with 'touch tone' frequency selection, auto scanning in three modes, repeater splits of any description, LED readout, channel memory, in-built NiCad battery pack, and much, much more: all in a powerful transceiver that fits into the palm of your hand. It's a technological breakthrough that you must see for yourself – at your nearest Dick Smith store.
Cat D-2888

$358.00

TERMS AVAILABLE TO APPROVED APPLICANTS

EVERYTHING *you want on 6m!*

Cat D-2886
$795

That's right – everything! AM, SSB, CW, FM – any mode you want to operate on. It covers from 50 to 54MHz (just in case we ever get the extra 2MHz!) AC and DC supplies are built in, so there's no power supply to pay for. 25 watts – more than enough output (25W on FM, CW & SSB). All the features you'd expect to find on a Yaesu – in short: magnificent!

LOOK! An LCD digital watch with alarm ● stopwatch ● split timing

Compare the value. Others sell similar watches for $100.00 and more. Look at our price! Quality electronics (made by one of the largest manufacturers in the world) and looks really impressive. Shows day/date/full time, plus alarm time set, stop watch time, lap times, etc. A brilliant gift idea!

Compare elsewhere at $100 and more! Our price:

$49.50

Cat X-1044

NEW TEST GEAR FROM DICK

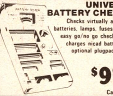
LOGIC PROBE.

Superb instrument: compatible with TTL and CMOS, shows high and low states, pulses, etc. Easy to use, handy for the experimenter's work box. Twin alligator clip leads for power, separate earth clip & probe.

$27.50

Cat Q-1272

UNIVERSAL BATTERY CHECKER



Checks virtually all common batteries, lamps, fuses, etc, with easy go/no go check. Also recharges nicad batteries with optional plugpack adaptor.

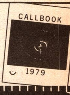
$9.95

Cat Q-1525

LAST CHANCE!

LIMITED STOCKS ONLY OF THE WIA 1979 CALL BOOK.

If you hang on any longer, you may miss out. We have only a few copies left. Lists amateurs and SWLs in Aust & PNG, plus loads of data. Every amateur & SWL needs a copy!



$2.95

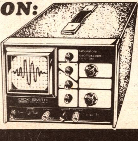
Cat B-2317

COMING SOON:
DICK SMITH 75MM CRO – UNDER $200.00!!!!!

Yes! A 5MHz laboratory oscilloscope just right for the service technician, amateur, audio buff, student, etc – and it is less than $200.00. Made especially for Dick Smith, this easy-to-use CRO should be available next month. It's worth the wait!

$199.00 Cat Q-1280

Don't buy a CRO until you see this one!



BUYING BY MAIL?

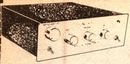
It's so easy! Simply list the items you want, with their catalogue numbers, and post it off with your cheque to our mail order centre (address at right). Don't forget to include post & packing (charges apply to total order value as per table at right).
Then watch your letterbox!

ORDER VALUE:	P&P
$5 (min) to $9.99	$1.00
$10.00 to $24.99	$2.00
$25.00 to $49.99	$3.00
$50.00 to $99.99	$4.00
$100 or more	$5.50

NOTE: These charges apply to goods sent by post in Australia only. Large and bulky items cannot be sent by post.
If you prefer, we will despatch your order by Comet Road Freight to anywhere in Australia for only $6.00 – that's below what it costs us! Large and bulky items are normally sent by Comet unless you specify differently (e by rail or air – you pay freight on delivery.

SUMMER PARTY TIME . . .

Get your parties really moving this summer with special lighting effects from Dick Smith.



MUSICOLOR Mk 3
Turn music into light! Plugs into any amplifier (won't harm or effect it) and uses music tones & strength to modulate light. A beauty! With full instruction book.
Cat K-3140

$65.00

DICK SMITH KITS COME COMPLETE, WITH FULL INSTRUCTIONS TOO!

Lights to suit Musicolour:
You asked for them — here they are!

White bakelite Edison screw lampholders. Simple to wire, screw holes for flush mounting. Cat P-5620
$3.50 ea

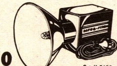
Par 38 pressed glass floodlamps in 4 cols, with internal reflector. Yellow (S-3850) Red (S-3852) Blue (S-3854) Green (S-3856)
$7.95 ea

Cat S-1200

$29.95

40 WATT UV FLUORO
Easy & effective party lighting! Just replace your 40W fluoros with these UV tubes. Clothes fluoresce in strange colours, yet it is completely safe. (NOTE: Be careful with some cheaper 'UV' tubes which may be harmful to the eyes. Our tubes are specially made to minimise short wave length UV).

NEW DISCO STROBE
Recently up-graded, now even more reliable. Brilliant white light flashes makes motion freeze, stunning effect. Easy to build kit, complete with instructions.



$34.50

Cat K-3152

DICK'S PLUGPACKS

3-6-9V @ 200mA

- Polarity reversible
- 4-way connector

Ideal for all small electronic appliances – radios, calculators, toys, etc. Saves you a fortune in batteries in a short time. Value! Cat. M-9525

WAS $9.50 . . . NOW ONLY

$6.90

NEED MORE OOMPH?

This brilliant 3-6-9-12 volt power supply pushes out a massive 1 amp – ideal for all those high current applications such as burglar alarms, larger toys, cassette recorders, etc. Screw terminals, so you can use on just about anything.

(Note: NOT a plug-pack)

$22.50

Cat M-9530

NEW! BY POPULAR DEMAND: VHF/AM 'COMMUNICATOR' RADIO

Remember the old VHF communicator radio? We sold thousands! Now, by popular request, here is a new VHF radio: The Communicator II.

Cat D-2833

Listen to the exciting world of VHF. Aircraft, amateurs, business radio, etc – even the sound signal from TV stations.

INCREDIBLE VALUE:

$59.00 –still at the old price!

Exclusive! Thick webbed shoulder strap for comfort. Handsome military look case.
Multi-section telescopic aerial adjusts for both vertical and horizontal polarization.
COVERS THE FOLLOWING:
AM (530-1600kHz) TV 1 (54-88MHz) FM (88-108MHz) AIR (108-136MHz) PB (135-174MHz) and CB (27-27.455MHz)

NEW! IDEAL FOR THE EXPERIMENTER

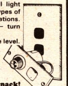
How many times have you been working on a circuit and needed a specific resistor? Our new resistance wheel, dials up the value you want! The handiest thing in your workshop or toolbox!

5 ohms to 1 megohm in 38 steps

Cat Q-1410 **$5.95**

IN THE MOOD!

Here's value: easy-to-install light dimmer supplied with two types of architrave plate: suits all locations. Full instructions provided – turn your harsh lights into soft mood lights . . . you pick the level. ONLY:



$6.90

Look for the bright new pack!
Cat X-1112

DEAR CUSTOMERS . . .
Quite often, products we advertise are completely sold out within a few days. Or problems may hold up delivery of promised goods so they are not in the stores when the advert appears. Please don't blame the store manager or staff: they are powerless to do anything about it! What we are trying to say is that, if you are about to drive across town to pick up a particular line, give the store a ring first . . . just in case!

Dick Smith and Staff

MINI DIP SWITCH

Ideal for use on PCBs, use for computers, etc. 8 SPST switches in one DIP package.
Cat S-1608
$2.75

BUILDING IC PROJECTS?

Use this IC insertion tool. Saves ruined MOS ICs, suits all DIP packages. Plunger action

$4.95

Cat T-4640

QUALITY TAPE!

Try it: you'll be surprised at the high quality for the low price!

C-60LN: Cat C-3350 **$1.50 ea** (10 up $1.00)
C-90LN: Cat C-3352 **$2.00 ea** (10 up $1.20)
C-90EDR Cat C-3354 **$2.75 ea** 10 up $1.90

SPECIAL:
Buy 10 tapes, mixed if you wish, and get our bonus book, Inside Story on Cassettes as well as discount prices above!

The inside story on cassettes
by Dick Smith

INCREDIBLE BARGAIN

Do you own a Fairchild Channel F video entertainment centre? Here's your chance to save a fortune. Dick's huge bulk buying has enabled prices to be drastically slashed on some cartridges. Buy now and save a fortune!!!
(NB: not all cartridges are reduced. See list below!)

BLACKJACK (Cat X-1201) TORPEDO ALLEY (Cat X-1211)
DESERT FOX (Cat X-1203) MAGIC NUMBERS (Cat X-1210)

ALL ABOVE NOW ONLY $5.00 EACH!

OTHER CARTRIDGES AVAILABLE:
Maze (Cat X-1204); Spitfire (Cat X-1206); Space War (Cat X-1207); Math Quiz 1 (Cat X-1208); Math Quiz 11 (Cat X-1209); Backgammon/Acey Ducey (Cat X-1213); Baseball (Cat X-1205); Sonar Search (Cat X-1214); Memory Match (Cat X-1215); Dodge-it (Cat X-1216); Pinball (Cat X-1217); Hangman (Cat X-1218); Bowling (Cat X-1221). ALL $24.50 EACH

AUTO 24 TUNE 'BELL'

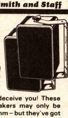
Remember the 'Chromachime'. We sold thousands! Here is a fully built up version of this popular circuit. 24 tunes, fully selectable. Comes complete with push-button for external mounting; so you don't have to buy one! Smart wood grain finish, ideal for mounting on or near door. Incredible value at our super introductory price:

$35

Cat X-1130

(The Chromachime was $49.50, in KIT form, and without a front door push button! Incredible!!!!).

HI FI IN MINI!



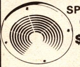
Don't let looks deceive you! These superb hi-fi speakers may only be 120 x 120 x 190mm – but they've got the performance of enclosures many times the size! Ideal for caravan or car, flat, etc, where space is limited. Try them! Cat A-2375

$99.50 pr

Your ears will say 'Thank You . . .'

HIDE IT!

SPEAKER COVER



$2.75

Cat C-2646

This one's for the tradesman and hobbyist. Installing intercoms, PA, background music, etc – use these flush-mounting speaker grilles. Great value, makes a neat job!

A $199.50 CB FOR ONLY $99.50????

Yes, the mighty Midland 886 base/mobile is sacrificed at less than half price!. 240 volt or 12 volt operation, deluxe set with phone and/or speaker. Save $100 by buying NOW – but be quick! While they last: Cat D-1438

$99.50!!!!!

WE'RE CHEAPEST!

YES! Compare our prices for zener diodes with anone else. You'll find we're cheaper by far – and you don't have to buy large quantities or special packs to get bargain prices from Dick Smith Electronics.

FIX A MIC OR MAKE A BUG

Microphone crook? Fix it with our elect. mic. inserts. They're great value! Or make a bug: they're tiny, and come with data.

1.95

Cat C-1160

BUDGET SWITCH PACK

Pack of 4 push button switches; col. tops for easy identification. Four colours available.

Cat S-1200

$2.50
(Pack of 4)

DICKTRACER Mk11 – NOW BETTER VALUE!

The improved Dicktracer Mk11 was superb value at $49.50. Internal batteries so there are no trailing wires; re-charges overnight from car cigarette lighter. Now it is even better value: we're practically giving them away! Now only

$39.50!
(was $49.50) Cat A-8500

Here it is! TI's superb TI58C prog.

Up to 480 program steps or up to 60 memories! Complete program editing features; up to 6 levels of sub-routine. And it has the constant memory™ feature. Retains information when turned off – you don't lose valuable information. Incredibly versatile instrument – call in and check it out! Cat Q-3705

ONLY . . . **$165.00**..

$18.00 WORTH OF SOFTWARE FREE!!
With each TI58C sold by Dick Smith Electronics, Texas Instruments will send, free of charge, two software 'Pakettes' of your choice (see list). Normally $9.00 each, yours FREE! (Coupon included with each TI58C)

THE PAKETTES AVAILABLE (only from Texas Instruments!): Electronic Engineering; Civil Engineering; Mathematics; Marketing/Sales; Fluid Dynamics; Statistical Testing; Securities; Oil/Gas/Energy; Blackbody; Astrology; 3D graphics; Production Planning.

MORE OF DICK'S BONZA BULK BUY BARGAINS – BEWDY!

Just a few left . . .

We've been swamped by the response to our 'bonza bulk buy' offers. And these 50k slider pots are no exception. If you want any, grab 'em quick!

R-1982

Quality 50k sliders from major manufacturer, at a crazy low price – way under normal retail!

60¢

BIG QUANTITIES:
Interested in buying (or selling) big quantities of 'bonza bulk buy' lines such as we show here? Talk to our marketing manager – Phone (02)
888 3200

FERRITE RODS:

How's this one – 194 x 9mm ferrite rods normally sell for $2.00 or more. Our normal retail price is $1.50. But as a bonza bulk buy for a short time only: **90 cents!** Yes, way under price, with dozens of uses for the electronics hobbyist: aerials, chokes, filters, audio supressor circuits, etc, etc. While our super special lasts; first come first served. Don't miss out on this one!

Cat L-1401

90¢ ea!!!

NEW! FOR THE HANDYMAN.

If your name is Adam and you're a Dick Smith purchasing officer, you'd describe this as 'sticky water proofing stuff'.
To anyone else, this is handy 'silicone sealant' – ideal for any waterproofing job such as antenna insulating, electronic ignition sealing, even fish tank making! Cat N-1225

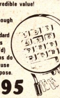
Huge 75g tube:

$3.95

PUSH BUTTON PHONE 'DIALS'

Incredibly popular, easy to fit. Remembers the last number dialled (up to 16 digits) for re-calling. Incredible value!

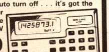
ATTENTION: Although these diallers fit perfectly into standard Australian 'phones (no soldering req'd) present regulations do not allow you to use them for this purpose.



$49.95

SAVE $15.00!

Another bargain buy from Dick Smith Electronics. You reap the benefit! Super slim card calculator, just slightly bigger than your bankcard, and only 3.5mm thick. Over 2000 hours life from one set of batteries; auto turn off . . . it's got the lot! Here's your chance to save was $29.50; NOW



$14.50
Cat Q-3022

Our headphones are great value!

$8.50

Cat C-4100

Budget model, comfortable, ideal for hi-fi or communications use. Complete with cord.

$14.00

Cat C-4102

Deluxe model, volume and tone controls inc. Fully adjustable, soft ear pads. A great buy!

Look for the bright new packs!

STOP PRESS

24.50

Cat X-1120

HUGE SAVINGS ON MAINS TIME SWITCH
Just plugs into p/point, plug appliance into it! Ideal for lights, pool filters, coffee pots, etc. Up to 6 on/off per 24 hours. Bewdy!

SPECIAL NOTICE TO OUR ADELAIDE CUSTOMERS
Thank you for your overwhelming support. Because of our tremendous success that you, our customers have made, we are moving to larger premises – double the size, to provide you with even better service.
We'll be closer to the heart of the city; near public transport – and for our customers who arrive by vehicle, we'll be able to provide you with the convenience of on-site parking for 21 cars.
Watch for our opening date – approximately February. Our new address will be 60 Wright Street, Adelaide – just up the street from our present store.

Dick Smith and Staff

DICK SMITH ELECTRONICS

NSW 125 York Street, SYDNEY Ph 290 3377
147 Hume Hwy, CHULLORA. Ph 642 8922
162 Pacific Hwy, GORE HILL. Ph 439 5311
30 Grose Street, PARRAMATTA. Ph 683 1133
263 Keira Street, WOLLONGONG. Ph 28 3800
ACT 96 Gladstone St, FYSHWICK. Ph 80 4944

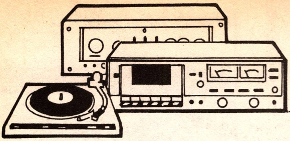
VIC 399 Lonsdale St, MELBOURNE. Ph 67 9834
656 Bridge Road, RICHMOND. Ph 428 1614
QLD 166 Logan Road, BURANDA. Ph 391 6233
SA 203 Wright St, ADELAIDE. Ph 212 1962
WA 414 William St, PERTH. Ph 328 6944

EXCEPT WHERE NOTED, ALL ITEMS SHOWN IN STOCK AT PRICES GIVEN AT TIME OF GOING TO PRESS.

MAIL ORDER CENTRE: PO Box 321, NORTH RYDE NSW 2113. Ph 888 3200. PACK & POST EXTRA.

bankcard
welcome here

SHOPS OPEN 9AM to 5.30PM
(Saturday: 9am till 12 noon)
BRISBANE: Half hour earlier.
ANY TERMS OFFERED ARE TO APPROVED APPLICANTS ONLY
RE-SELLERS OF DICK SMITH PRODUCTS IN MOST AREAS OF AUSTRALIA.



Hi Fi Topics

WE TURN BACK THE CLOCK WITH A PIONEER IN FERRITE TECHNOLOGY

An interesting facet of hifi history was highlighted recently with the visit to Australia of Dr Takeshi Takei, a notable pioneer in the field of ferrite materials. Over lunch at Sydney's Woolshed restaurant, Dr Takei turned the clock back to around 1930, when the main connotation of iron oxide was — rust!

by NEVILLE WILLIAMS

Dr Takeshi Takei

Retired and in his eighties, Dr Takei, accompanied by his wife, was enjoying his first visit to Australia. His visiting card carries the endorsements "Professor Emeritus of Tokyo Institute of Technology" and "Professor Emeritus of Keio University". Not mentioned is the fact that he has been — and still is — organising chairman of the International Conference on Ferrite (ICF), the next one being scheduled for Sept 30-Oct 3 next, in Kyoto, Japan.

Significantly, the call for papers for this conference lists a dozen major aspects including, of course, "Magnetic recording media and head materials, inclusive of related materials such as fine metal particles and amorphous materials"!

Behind Dr Takei's visit lies a lifetime devoted to research into ferrites — materials based on the oxides of iron but variously mixed, doped, processed, pressed, extruded, heat treated, sintered and so on, for a multitude of roles in electronics.

Nowadays, most such applications are taken for granted, although some still manage to make the headlines — like last month's story on ferromagnetic fluids.

Dr Takei himself is obviously intrigued by novel — even way-out — roles for his beloved ferrites. Without going into a lot of detail (his English is better than my Japanese) he mentioned their use in steam generators to humidify homes, and as insoluble anodes for the cathodic protection of metals, or in electrolytic processes. They hold continuing promise as protective surface coatings and for use in the recovery of precious metals from waste.

At a physiological level, Dr Takei mentioned the magnetic necklets and bracelets already being marketed by TDK as a method of alleviating some symptoms of arthritis. They work for some people, he says, but no one is yet sure why.

Research is also continuing into the use of ferrites administered internally. They may emerge as a desirable substitute for barium-sulphate for X-ray examination procedures, and they offer the interesting possibility of being subject to manipulation and concentration by means of magnetic fields.

All this is a long way from the situa-

Major reorganisation at Convoy/TDK

For several years, the two-buildings-in-one, in Dowling St Woolloomooloo, occupied by Convoy International has been the Australian outlet for a range of notable hifi products, including B&W loudspeakers, Nakamichi tape equipment and TDK tape. At one stage, an associated retail outlet offered a range of other brands and models, but this was discontinued so that the Company could concentrate on its prime role as a distributor.

Convoy's association with TDK had begun in 1970 and resulted in what was probably the first effective penetration by a Japanese tape into the Australian quality market. Recently, with an upsurge in sales in the audio market, and with video tapes also coming on strongly worldwide, TDK decided that the time had come to establish their own direct outlet for TDK products in Australia.

In so doing, they chose to build on the nine-year-long association with Convoy. Mr Malcolm Goldfinch, founder and formerly Managing Director of that company, was invited to become a venture partner and Chairman of Directors of TDK (Australia) Pty Ltd — an appointment which he was happy to accept.

The new company is operating from the same Convoy premises at 4 Dowling St, Woolloomooloo, NSW, with a new telephone number (02) 358 2088. Managing Director is Akio (Alex) Akakura, formerly of TDK, Tokyo. He is resident in Sydney and hosted the recent visit by TDK's pioneer consultant, Dr Takeshi Takei.

Malcolm Goldfinch retains a personal link with Convoy International, as its Chairman, but has relinquished his role as Managing Director. That position is now held by Mr Alex McInnes, also a 50% shareholder. Mr McInnes, up till recently, was Managing Director of Lanray Industries Ltd.

Mr Geoff Matthews, who started with Convoy in 1970 as an apprentice in electronics service, is now Sales Manager for Nakamichi and B&W hifi products.

The Convoy-Electrosonic Audio Visual Products and Convention Centre is now managed by Mr Peter Worrall.

tion in the late twenties and I quote: "Until about the 1930s, the physicist viewed ferrites as ferromagnetic substances; the chemist viewed them as a kind of ferric salt; and the mineralist as a kind of spinel crystal."

It was around this time — 1927 — that Takeshi Takei graduated from the Faculty of Science (Chemistry) at Tohoku University, obtaining his Doctor of Science degree in 1932. In the meantime, he had taken a position of assistant professor, later professor, at the Tokyo Institute of Technology.

But motivating his academic career was a dominating interest in ferrites and he made a vital contribution to worldwide research which, by about 1935, had begun to move them from science labs into industry.

What Dr Takei could not have known was that research of another kind was in progress in Europe that would ultimately have a large impact on his own future.

In the late twenties, considerable attention was being focused on magnetic recording, with quite diverse objectives in view: Like recording speech over the telephone, or information for military use, or sound for motion pictures, etc. Basic principles had been established, along with the use of DC and AC bias, but the medium was invariably steel wire or steel tape.

However, a group of German engineers decided to concentrate on a magnetically sensitive coating applied to paper tape. Their first efforts were likened to a long, flexible "file", with coarse particles adding to the natural grain of the paper!

BASF and other companies involved in the effort overcame one of the problems by substituting plastic tape for paper but the metallic iron particles posed much greater problems. In particular, they were chemically unstable, showing a strong tendency to oxidise into rust, and then to flake off.

In an historic "can't-lick-em, join-'em" move, the decision was taken to coat the plastic tape with a magnetically sensitive oxide of iron. It worked and modern magnetic recording tape was born.

BASF made history by recording an orchestral concert in the Ludwigshafen Town Hall, in November 1936, by the London Philharmonic Orchestra under Sir Thomas Beecham

Amazingly, even though a British Orchestra was involved, the significance of the occasion appears to have been completely lost outside Germany. Perhaps it was the complete preoccupation elsewhere with disc technology.

It is sufficient to say that, while others went on fiddling with magnetic wire recorders for voice applications, German engineers developed coated tape technology to radio broadcast standards. It was re-discovered a decade

ORTOFON TRIMS BACK THE MOVING MASS EVEN FURTHER

Not prepared to let matters rest with their Concorde 30 series cartridges (September '79 issue, page 42), Ortofon have gone a step further and produced an integrated cartridge and arm designed to plug directly into the SME series III or series IIIS pickup assembly. It does away completely with the normal arm and headshell.

Designated as the Ortofon/SME 30H Low Mass Integrated Pickup Cartridge and Carrying Arm, the unit has a total weight of 10.5 grams, which is less than many headshells alone. The effective moving mass is given as "a mere 4.5 grams".

In association with a dynamic compliance of 35um/mN, it yields a system resonance of 13Hz, which is ideally placed between the lowest deliberate signal frequencies and the still lower frequencies where rumble, warp effects and acoustic feedback tend to concentrate. Ortofon claim a particularly clean bass response, with the least possible interference from spurious very low frequency energy.

These characteristics, aimed at optimum performance in the bass region, have been complemented by a special stylus design, which provides an effective tip mass of 0.35 milligrams. This has been achieved with a precision-ground natural diamond stylus and a very lightweight hardened aluminium cantilever. The assembly is enclosed in an annealed permalloy shield, which effectively excludes hum fields.

Using what Ortofon describe as their "VMS" principle, the 30 series cartridges are essentially of moving armature "magnetic" design, which offer a nominal output of more than 3mV at 1kHz (5cm/sec peak). They are therefore suitable for direct connection to a standard amplifier "phono" input. Frequency response is shown as virtually ruler-flat from 20Hz to above 20kHz, except for a 1dB bump at 18kHz.

Also pictured is the new Ortofon MC20 MkII moving coil cartridge, which incorporates some of the forward looking technology pioneered in the 30 series. It is a low output, unit cartridge requiring an appropriate transformer or pre-preamplifier. It offers a response which is virtually flat to 20kHz, but extending into the 40kHz region.

For further information on Ortofon cartridges: Harman Australia Pty Ltd, 271 Harbour Rd, Brookvale, NSW 2100. Phone (02) 939 2922.

Sanyo's new 3-in-1 model JXT6430K has an integrated tuner/amplifier providing AM/FM coverage with tuning meter, and 7 watts per channel into floor-standing speakers. It also accomodates a front loading cassette and a phono player with magnetic cartridge. Price is $479. (Sanyo Aust Pty Ltd, 225 Miller St, North Sydney)

Professional Sound Systems Start With The Stanton 881S

Stanton Magnetics presents the new 881S Professional Calibration Standard Cartridge. It's the cartridge preferred by recording engineers worldwide and it assures a new standard for home audiophiles desiring the very best in recorded sound.
Its patented, low mass Stereohedron™ stylus tip makes possible the flawless reproduction of high velocity modulations present on today's finest recordings.
The Stanton 881S. . .where great sound begins.

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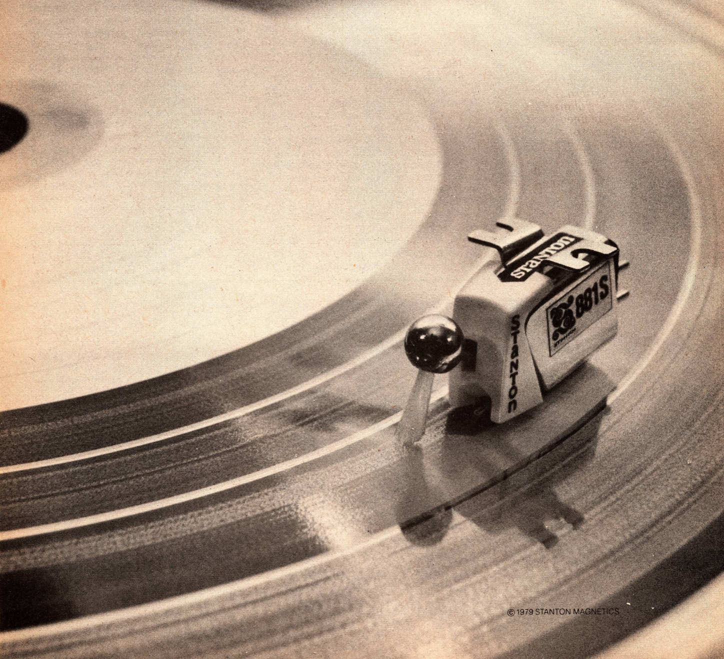

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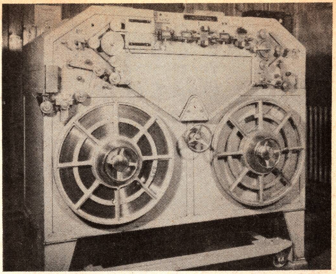
Tape recording in the 30's

The BLATTNERPHONE



Dear Mr Williams,

I refer to your article in the "Sydney Morning Herald" "Tape Technology Goes Back to Its Roots" (13/11/79, p19).

I do not recall the paper tape you mentioned (circa 1930) but, in 1935, I worked for Marconi's in Chelmsford, UK, where we tested all the "Marconi-Stille" machines, known in the BBC as "Blattnerphones".

These were the BBC's principal means of recording music for re-broadcasting and they provided a "fi" higher than any I have since experienced. The cost of this was heavy, however.

A Blattnerphone was about the weight and size of an upright piano. The solid steel tape was polished spring material of a special composition, made satisfactorily only by one Swedish company. It was very hard and very brittle. To my recollection, it was about 4mm wide and about 0.2m thick and was supplied on skeletal aluminium spools of about 500mm diameter, and about 50mm thick at the hub. They weighed several kilograms when full of tape and played for about 20 minutes.

The two spools sat on the front of the machine, as on a modern professional tape recorder and the tape was intricately threaded through capstans, pulleys, heads and peculiar loop reservoirs with glass front, through which the "can-of-worms" of tape loops could be seen writhing in a seemingly random pattern.

Complex and powerful machinery spun the spools, sensed the loops and maintained accurate head speed. This must have been of the order of a metre per second, judging by the pile of tangled steel which appeared on the floor before the machine could be switched off, whenever the tape broke. Such catastrophies were accompanied by a sound like the drawing of a thousand swords!

The sound heads were cubical structures about 30mm each way, made of loaded ebonite, with inserts of elephant-tusk ivory. This was found to be the only insulating material available and capable of taking the rub of the steel tape without wearing out too fast. (Metallic rubbing parts produced both acoustic and electrical noise and were unacceptable).

In place of the modern high-reluctance narrow gap, used for writing signals, the Blatterphone used a low reluctance narrow gap, that is, a silicon steel knife edge at right angles to both the axis and the surface of the tape and pressed against the tape by light springs. There were two of these tiny knives in each head (each with its surrounding small coil of many turns of fine wire) on opposite sides of the tape but not directly opposite each other.

With a large "stagger" between the two knives, the tape would have been magnetised longitudinally. However, a micrometer adjustment allowed the stagger to be made comparable with tape thickness, giving a top frequency of about 10kHz (as I recall) before the magnetisation began to tilt so far as to reduce the signal unacceptably.

With clean tape and well adjusted heads, the quality and freedom from noise was superb. For the first time in my life I heard a piano sound like a piano when recorded and replayed. Clearly, the phase and amplitude roll-off at the top end of the frequency band, when the knives were optimally adjusted, gave critically damped response to sharp-edged transients.

A recorded sinewave tone, when replayed and displayed on that new-fangled gadget, the cathode-ray oscilloscope (yes, we had CROs in 1935) came though steadily, as from a tone generator. There were no signs of fuzz, dropouts, or amplitude waver, of even one cycle duration, such as still occur with oxide tape. Any perceptible signs of "wow" were grimly chased out of the system, even at the expense of re-machining the high-precision parts!

If we are to consider metal tape coming back, the Blattnerphone, which was pretty certainly the world's first viable commercial tape recorder, needs to be mentioned along with any other system which might have been suggested at the time. V.T. (Drummoyne, NSW)

Editor: The so-called metal tape which is currently the subject of attention is not is all-metal ribbon, as used by the Blattnerphone. It has the normal kind of plastic base but is coated with microscopic particles of pure iron, rather than of a magnetic oxide.

HIFI TOPICS — cont.

later by invading American forces, to trigger a major post-war hifi revolution.

Within a few years, a new worldwide industry had been born, involving a layer of finely divided magnetic oxide on millions of kilometres of recording tape.

Not surprisingly, Dr Takei soon became involved in this new field. During the war he had remained as a Professor at the Tokyo Institute of Technology and, while he later continued on with his academic career, he became associated with TDK as a scientific consultant.

The association has been maintained right through to the present and his visit to this country was hosted by the newly formed TDK (Australia) Pty Ltd.

☆ ☆ ☆

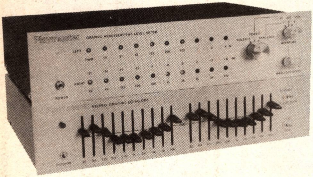
BRITISH MERCHANDISING Pty Ltd have renewed an association which dates back to 1948 when they introduced what was claimed to be the first tape recorder on to the Australian market — a British made Ferrograph. One of those same recorders is still on display and operating in the Ferrograph showrooms. But things have changed.

Some years ago, Alan Helliwell, formerly chief engineer and chief executive of Ferrograph, left the company to form NEAL, with the intention of pioneering casette recorder manufacturer in Britain. The venture prospered, to the point where it was able to purchase the Ferrograph company in October 1977. Now the combined operation, NEAL-FERROGRAPH is based in a modern factory at South Shields, Tyne and Wear, England, and is offering both cassette and open reel machines to suit a broad range of prospective users, right through to recording and broadcast studio operators.

As an extension of this reorganisation, Australian distribution of all NEAL and FERROGRAPH products will be handled by British Merchandising Pty Ltd (Mng Dir H. C. Long), Shaw House, 49-51 York St, Sydney 2000. Phone (02) 29 1571.

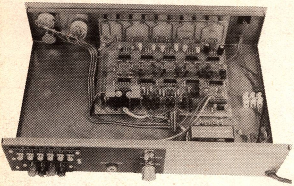
Next Month

Don't miss our exciting Graphic Analyser/Peak Level Meter



Anyone who has purchased or built a graphic equaliser will not want to miss our major contructional article on a graphic analyser. A graphic analyser is absolutely essential if you are ever to make practical use of a graphic equaliser. Our Playmaster analyser matches any equaliser and has a built-in pink-noise generator and microphone preamplifier for monitoring loudspeaker and room response.

When not in use as a graphic analyser, it doubles as a dynamic stereo display of amplifier power output or signal levels. All this is easy to build and uses just 13 low cost ICs. An internal view of the prototype is shown below.



PLUS MUCH MORE

Next month will be really chock-full of feature articles, constructional articles, computers, hifi.

Our planning for this issue is well advanced but circumstances may change the final content. However, we will make every attempt to include the article mentioned above.

HIFI TOPICS — continued

The new Technics SL-1600MK2 "quartz synthesiser direct-drive fully automatic turntable", features near-instantaneous start-up, high running torque and electronic braking for a quick stop. The front, soft-touch controls operate through a microcomputer, which also reacts to the size of record (if any) on the turntable, through infra-red sensing. Other features include a quartz-controlled stroboscope, pitch control, pop-up stylus illumination, and a double suspension system intended to provide a high degree of acoustic isolation for turntable and arm. Performance figures listed are in line with what would be expected of a top grade phono deck. While the SL-1600MK2 is fully automatic, two other models are available in the range with virtually the same basic performance specifications: the SL-1700MK2 semi-automatic player, and the SL-1800MK2 manual model. (For further details: National Technics Advisory Service, P.O. Box 278, Kensington, NSW 2033).

ELITE ELECTRONIC INDUSTRIES Pty Ltd advise that, after lengthy negotiations, they have arranged for sole distribution of EEI cartridges and EEI replacement styli in New Zealand to be handled by the well known audio manufacturer, Zetka Industries. For further information, New Zealand readers should contact Mr Paul McLaren, Zetka Industries Ltd, 65 Pharazyn St, Lower Hutt, NZ. Phone (4) 664 193. In Australia, Elite Ind. Pty Ltd are at 36 Luxmoore St, Cheltenham, Vic 3192. Phone (03) 93 1201.

DYNAVECTOR made news about three years ago with a moving cartridge having sufficiently high output to work directly into the "magnetic phono" input of a normal amplifier, without either transformer or pre-preamp. They have now introduced their 20A and 20B Mark 2 cartridges, in which the mass has been reduced from 9.5 to 5.3 grams; compliance has been increased by a factor of three and output increased from 2mV to 3.6mV. Prices are $175 and $225 respectively.

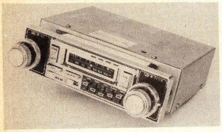
Equally interesting are the Dynavector 100R and 100D car-

TRADEMARK NOTICE

ULTRA DYNAMIC: On page 33 of our May 1979 issue, mention was made of cassettes being marketed by the Dick Smith organisation and described as "ultra dynamic high density" tapes. We have been advised by F. B. Rice & Co, Patent and Trade Mark Attorneys, that the words, "ULTRA DYNAMIC" are the registered trade mark of Hitachi Limited and therefore should not be used in connection with tapes other than those of Hitachi Limited.

tridges — low output moving coil units with very short cantilevers and a high natural resonance, which largely obviates dependance on damping. The 100R using a synthetic ruby cantilever, retails at $198 to which may have to be added $175, being the cost of an appropriate step-up transformer. But the 100D, using a diamond cantilever, retails for a whopping $998! For further details: Concept Audio Pty Ltd, 22 Wattle Rd, Brookvale, NSW 2100. Telephone (02) 938 3700.

FERRIS AUDIO PRODUCTS have launched a near car stereo/radio that incorporates a graphic equaliser, yet takes up no more space than a conventional car cassette system. Designated as type JMPA-5020, it offers a power output of about 6W per channel, local/DX switching, FM muting, auto stop, lock-in fast forward and balance control. The equaliser has a range of +/-12dB centred on 60, 250, 1000, 3500 and 10,000Hz. The JMPA will retail for just under $200. Ferris suggest, as most appropriate, that it be used with a pair of triaxial speakers. (Information: Mr J. J. Manneken, Ferris Audio Products, 42 Grantham St, West Brunswick, Vic 3055.



PYE LIMITED of Cambridge, UK, have issued a 20-page booklet to mark the 50th anniversary of the company. They state that copies are available to members of the public on application to Pye Ltd, Publications Department, 137 Ditton Walk, Cambridge, UK. To the best of our knowledge the books are not available from any source in Australia. Written by Gordon Bussey and illustrated by pictures of early Pye receivers, the book draws heavily on the recollections of Harold J. Pye, who joined his father in the business in 1923 and is the last surviving partner of the original W.G. Pye & Co.

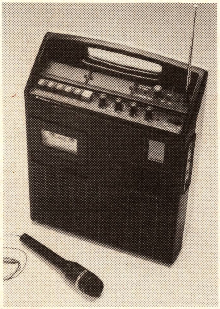
AUDIO DESIGN of 3/7 Harvton St, Stafford, Qld 4053, have a short-form four-page catalog/brochure which shows an impressive array of locally produced professional audio equipment. It lists three stereo power amplifiers, one of them rated at 300W per channel. There are two active two-channel crossover networks, one a three-way and the other a two-way, with power drive to the treble channels. There is a stereo preamplifier, a 10-band graphic equaliser, and a six-channel stereo disco-mixer — all the above units being intended for rack mounting. Other units include a 10-channel microphone console mixer, a range of powered loudspeakers rated up to 200W program, and several open chassis power amplifiers for OEM installation. Other specialised audio modules are currently under development. The address for further information is as above. Telephone (07) 356 9191.

AMPEX AUSTRALIA Pty Ltd have a new range of accessories which enhance the capabilities of their ATR-100 professional recorder:

- A quick mount ½in, two-track head assembly offering a S/N ratio of 80dB at 30ips.
- ADD1 digital delay system, which can eliminate the need for a sampling loop, while retaining the 80dB S/N ratio.
- A plug-in EQ Padnet which can provide switchable four-speed operation, or separate equalisation for two-speed operation.
- A four-speed editing kit.
- An ATR-100 cue amplifier, providing for monitoring of either or both channels, with level control independant of normal I/O module settings.

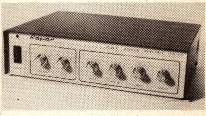
For information: Ampex Australia Pty Ltd, 4 Carlotta St, Artarmon, NSW 2064.

NATIONAL PANASONIC AUSTRALIA PTY LTD have just released a potentially very useful portable P.A. system. The unit is self-contained, with in-built oval woofer and separate tweeter, and can operate either from internal batteries or mains power. In the latter case, rated output is 15W. There is provision on the side for external mic. and aux. input but it has in-built provision for use with one or two wireless microphones. The WX-730 (pictured) also incorporates a cassette system which can record proceedings or alternatively be used as a signal source. RRP is $459, microphone(s) extra. Details from National Panasonic Aust Pty Ltd, 57 Anzac Parade, Kensington, NSW 2033.



Rapar

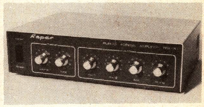
PUBLIC ADDRESS AMPLIFIERS YOU CAN DEPEND ON



TPA 50

Specs.
RMS power, 25 watts. Frequency response: 50Hz to 15kHz (+3dB at 8 ohms). Multiple outputs: 4, 8 and 16 ohms. 70 and 100 volt lines. Inputs: Mic. 1, 47k ohms, Mic. 2, 600 ohms. Aux. 300mV, Phono 2.5mV.
Size: 310mm (width), 230mm (depth), 80mm (height). Weight 3.8 kilos. Finish: Durable two-tone baked enamel.

***$146.97**



MODEL TPA 70

Specs.
RMS power, 50 watts. Frequency response: 50Hz to 15kHz (+3dB at 8 ohms). Multiple outputs: 4, 8, 16 ohms, 70 and 100 volt lines. Inputs: Mic. 1, 47k ohms, Mic. 2, 600 ohms, Aux. 300mV, Phono 2.5mV.
Size: 310mm (width), 230mm (depth), 80mm (height). Weight: 4.3 kilos. Finish: Durable two-tone baked enamel.

$183.60

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JVC KD-A8 microprocessor controlled cassette deck

JVC have set a world first with the recent release of their new KD-A8 microprocessor controlled cassette deck. The microprocessor automatically optimises bias and equalisation during recording and results in consistently good recordings with a wide variety of tapes, even the new metal particle tapes. Combined with their Super ANRS system the KD-A8 has perhaps the best frequency response we have ever seen from a cassette deck!

Considering the ever increasing variety of tape formulations it is clearly impossible for cassette deck manufacturers to optimise bias and equalisation with just three standard positions, viz, normal, FeCr and Cr02. The solution of course is for the cassette deck to record and playback test signals on the cassette itself and then optimise bias and equalisation accordingly. This is just what JVC have done with their BEST system which is an acronym for bias, equalisation and sensitivity tuning.

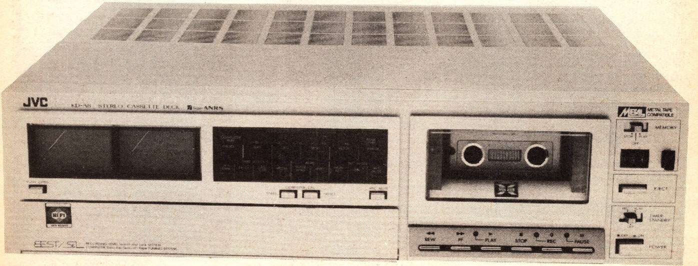
In terms of performance optimum bias gives the best compromise between distortion and high frequency response, while optimum recording equalisation leads to a flat and extended high frequency response. The frequency response we obtained from a TDK-SA and a Maxell metal tape are both shown in an accompanying diagram. They are quite remarkable considering that the response was measured at 0dB not -20dB; in fact most decks will start rolling off rapidly after 8kHz while response of the KD-A8 is within +/-1dB from 40Hz right up to 13kHz.

The extended high frequency response at 0VU is also due to JVCs Super ANRS system, which is basically a high frequency "companding" system, ie the dynamic range of the high frequencies is compressed during recording and expanded to its original range on playback. This has the distinct advantage of preventing tape and recording head saturation, so high frequency response is extended and intermodulation distortion is greatly reduced. Signal to noise ratio is also markedly improved by the system.

Companding is not a new idea but the reason it is not normally used for cassette decks is that peaks and troughs in the frequency response of a tape are magnified by the compression ratio causing unacceptable degradation of the frequency response. Since JVCs BEST system provides an optically flat frequency response regardless of the tape used, this problem is largely overcome. The sensitivity adjustment also provided by the BEST system keeps the recording and playback levels the same so that the compander threshold is constant, resulting in accurate expansion and flat frequency response at all signal levels.

Apart from its performance the most remarkable feature of the KD-A8 was to be its space age appearance. Considerably larger than most cassette decks it has quite a deep case and a wide low profile front panel in a silver finish. The usual piano key controls for tape motion, ie play, fast forward etc, are replaced with micro switches, and as well as conventional VU meters there is also a large LED peak level meter and tape status display.

Additional controls are located along the bottom half of the front panel behind a matching swing down panel. The usual input and output level controls, phones output, microphone input, and tape selectors are present but there are also a few surprises. Included is an automatic recording level control which JVC call S&L for search and lock. While the input can also be manually set, the S&L



mechanism when switched to "S&L set" will find the peak level in the signal being recorded and adjust the recording level appropriately.

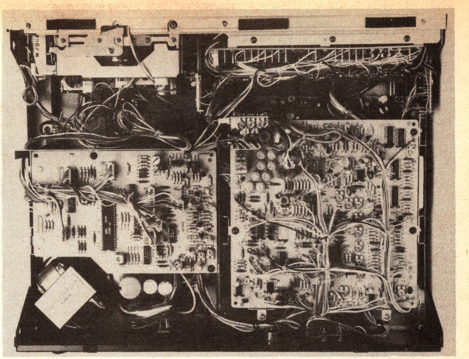
The tape selector is used for both BEST optimisation and for manual setting of the bias and equalisation. It has three positions, viz Cr02/normal, FeCr and Metal. While the Cr02 and normal tapes occupy the same switch positions they are distinguished by the coding notch found alongside the recording tabs at the top of chromium tape cassettes. The preset button can be used to manually set the bias and equalisation for the tape selected and a LED display indicates the tape from either metal, SA/Cr02, FeCr and normal.

If, prior to recording, you select the BEST system rather than the preset bias and equalisation, then the action really starts. The cassette deck goes into a sequence of fast-forward, record, playback and rewind, taking about 10 seconds to complete optimisation, all without human intervention. First the bias is optimised by recording a 1kHz reference signal and then a 6.3kHz signal with the recording bias current varied in 32 steps, this is then played back and the signals compared to determine optimum bias. Equalisation is next with a complex sequence of eight steps of a 10kHz signal followed by 16 steps of a 1kHz signal which are compared on playback by the microprocessor to set equalisation.

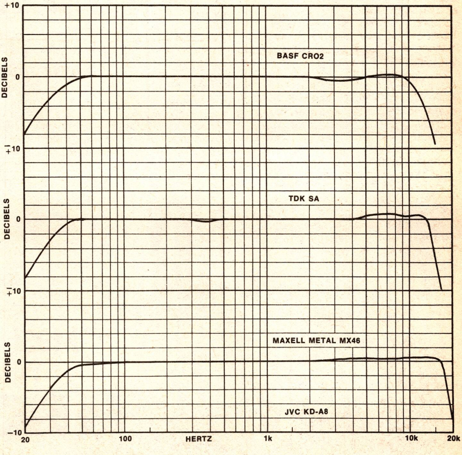
The microprocessor responsible for all this is a 42-pin dedicated device, which far from having a recognisable bus, provides individual output lines for such functions as the FF, Rewind, REC, PLAY and some of the front panel LEDs. Despite the use of quite a few complex ICs such as specialised controllers, Super ANRS IC circuit and a lot of CMOS, the KD-A8 has a vast amount of circuitry. In all, there are 53 ICs, 91 transistors, 97 diodes and 23 LEDs!

Most components are mounted on four major boards; as you can see from the photograph of the internal layout of the deck, it is quite a spectacle. The cassette machanism consists of two motors, one driving the capstan and the other driving the cassette reels, plus three solenoids which actuate the pause mechanism, play and erase head cue and the reel brake.

The operation of the mechanism was very satisfying; in fact we could not fault it with any combination of rewind, fast forward and play. The electronics automatically pass through the proper sequence; for example when changing from rewind to play, the brake solenoid is applied first, the direction of the reel motor's motion is reversed and the head-cueing solenoid pushes the record and play heads into position, and the capstan motor turns on. The pause mechanism also works well — the motors are kept running but the reel brake is applied and the pause solenoid retracts the pinch roller, just like a mechanically actuated deck.



53 ICs, 91 transistors, 97 diodes and 23 LEDs make up the semiconductor complement of the JVC KD-A8. Below are the frequency response curves which were measured at 0dB recording level using Super-ANRS.



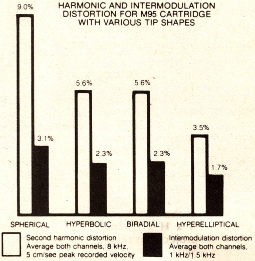
Other features of the KD-A8 are the timer standby and counter memory. The timer standby can be switched to either record or playback so that when an external timer switches on the power to the deck it will then start either to record or playback. The counter memory is also useful as it allows the deck to either fast-forward or reverse to a previously marked position and then start playback.

(continued on page 41)

fact: dramatic freedom from distortion comes to a mid-priced cartridge: the new Shure M95HE...

an affordable, audible improvement

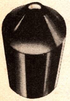
One of the critically acclaimed advances introduced in Shure's incomparable V15 Type IV pickup is its revolutionary and unique distortion-reducing Hyperelliptical stylus. Now, you can enjoy this standard of sound purity in a new, ultra-flat frequency response, light tracking, high trackability cartridge that will not tax your budget: the new Shure Model M95HE.



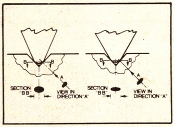
a measurable drop in distortion

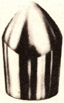
As a result of the optimized contact area of the Hyperelliptical tip, both harmonic distortion (white bars in graph above) and intermodulation distortion (black bars) are dramatically reduced.

the Hyperelliptical stylus tip



BIRADIAL (ELLIPTICAL) STYLUS SUCH AS IN M95ED





HYPERELLIPTICAL STYLUS OF THE M95HE

The Hyperelliptical nude diamond tip configuration represents a significant advance in tip design for stereo sound reproduction. As the figures show, its "footprint" (represented by black oval) is longer and narrower than the traditional Biradial (Elliptical) tip-groove contact area. Because the Hyperelliptical footprint geometry is narrower than both the Biradial and long-contact shapes such as the Hyperbolic, it is pre-eminent for reproduction of the stereo-cut groove.

upgrade your present M95 If you already have a Shure M95 Series Cartridge, you can improve its freedom from distortion right up to the standards of the new M95HE cartridge simply by equipping it with a Model *N95HE* stylus. The cost is extraordinarily low — yet the difference in sound will be immediately apparent. Takes only seconds to install — requires no tools whatsoever.

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AE142/FP

Teac A-430 cassette deck has "auto bias" and three heads

Now that three-head cassette decks are fairly commonplace on the market, a few manufacturers have intoduced a very well-worthwhile refinement — bias optimisation. One of these manufacturers is Teac Corporation who have just released their model A-430 with automatic bias optimisation.

In appearance, the new Teac A-430 stereo cassette deck is very similar to the A-300 and A-107 models which we reviewed in June 1979 and August 1978 respectively. It has much the same control layout although the functions and labelling are changed in some cases. The front panel finish is darker, akin to a brushed "gunmetal" — which might not sound particularly attractive but it really does look well.

Overall dimensions of the A-430 are 415 x 154 x 295mm (W x H x D) including knobs, rear projections and rubber feet. Mass is 8.5kg.

The transport mechanism is the well proven seven-lever front-loading unit used in other Teac models, together with the combined dual recording and playback head as used in the A-300 model.

Recording facilities on the A-430 are the same as the A-300 in that it has mixing for microphone and line inputs. This is provided with two concentric knobs. Four bar-shaped push-buttons provide the following functions: Auto-Bias, Equalisation (for metal tape or others), Dolby Noise reduction and Monitor. Equalisation settings for conventional ferric oxide or chromium dioxide tapes are selected automatically by the A-430.

The Monitor function allows monitoring of the source being recorded or the signal off the tape. The A-430 has four Dolby noise reduction integrated circuits (Signetics NE645B) so the noise reduction facility is available for off-tape monitoring. There is no output level control but this is not really necessary.

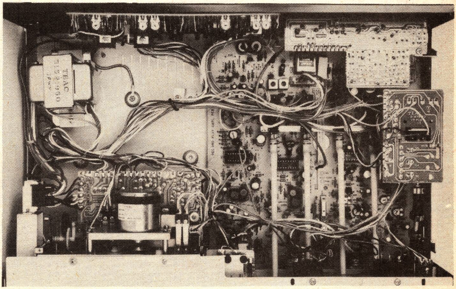
The most important feature of the A-430 system is the automatic bias optimisation. This is very simple to use. All that has to be done to set the optimum bias for any cassette is to set the deck in record mode and depress the Auto-bias button. The bias knob at the right-hand side of the panel then rotates of its own accord to the accompaniment of a flashing LED indicator. When the knob comes to rest (within one revolution or less) the optimum bias is set.

How does the Teac do it? Well, it records a 10kHz signal on the tape and adjusts the bias with a motor-driven potentiometer. At the same time, the deck monitors the playback signal and stops the potentiometer motor when the signal level is at the optimum (factory set) level.

While this scheme is nowhere near as complicated as that used in the microprocessor-controlled JVC KDA8 deck which is also reviewed in these columns, it is also a good deal cheaper, as a package. It enables far better results to be obtained from a much wider range of tapes than is possible with any deck with the usual two or three fixed bias settings.

Considering that the A-430 is a three-head machine with this automatic bias

Teac's auto-bias feature consists of a motor driven potentiometer which varies the bias while the response to a 10kHz signal is measured.



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Photograph shows speakers without front grilles.

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*Based on the price of the 300mm system in ready built form.

Specifications	200mm	250mm	300mm
Speaker Enclosure:	26 litre, infinite baffle	53 litre, infinite baffle	75 litre, infinite baffle
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Frequency Response:	45Hz - 20kHz	35Hz - 20kHz	28Hz - 20kHz
Impedance:	8 ohms	8 ohms	8 ohms
Power Rating:	40 watts music	60 watts music	80 watts music
Total System	**$149.50**	**$224**	**$284**

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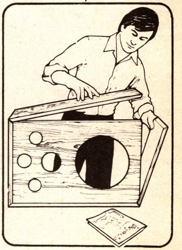

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TEAC-A430

facility, its internal layout is quite open and uncomplicated. Comparison with the A-300 model shows that it has an extra two PC boards, one to accomodate the motor/potentiometer assembly and one to drive it all. Total semiconductor count is 4 ICs, 1 SCR, 2 LEDs, 32 diodes and 61 transistors.

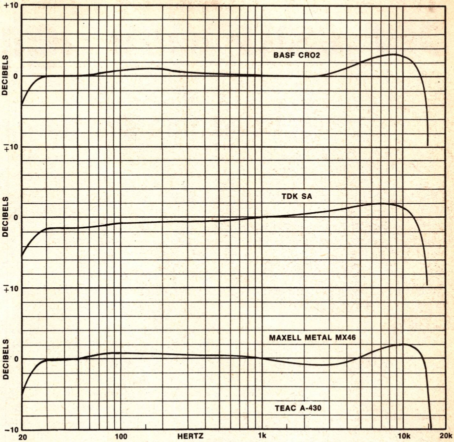
Our sample A-430 deck was wired for Australian conditions. Teac also produce a general export model as well as models for Europe, the UK and USA and Canada.

Our test results show the performance of the Teac A-430. The whole story is told by the response curves acheived for three tapes. Quantifying those results, for the TDK SA tape for example, gives a result of 30Hz to 12.5kHz within ±2dB with or without Dolby noise reduction. This was better than the equivalent result achieved by the three-head A-300.

The frequency response curves were taken at -20dB below 0VU. At -10VU, harmonic distorition was typically 1% at 1kHz and lower frequencies but at 10kHz it was typically 3.6% (with Dolby applied) which is on the high side.

Signal-to-noise ratios were good. With Maxell metal tape, we measured 57dB unweighted with Dolby applied and 52dB unweighted without Dolby. Similar figures were achieved with TDK SA and BASF Chromium Dioxide tapes.

Wow and flutter checked out at typically 0.15% according to the DIN 45507 measurement.



Record/replay performance on music programs was well up to the standard indicated by the performance tests. There was very little deterioration between source and tape on most music, particularly when Dolby was applied. However, we would still like to see some sort of LED overload indicator so, that optimum signal levels could be recorded.

Our overall reaction to the Teac A-430 is very favourable. The A-430 offers the facilities of a three-head fully Dolbyised machine together with innovation of automatic bias optimisation, all at a bargain price. Recommended retail price is $366, including sales tax.

Further information on the Teac A-430 can be obtained from high fidelity retailers or from the Australian distributors, Teac Australia Pty Ltd, 165 Gladstone Street, South Melbourne, Victoria. (R. de J. and LDS).

JVC KD-A8 . . . from P37

Now let us discuss the measured performance. The two frequency response curves mentioned earlier tell most of the story. Not only is high frequency response remarkably extended but the overall frequency response is very flat. Most decks would be considered superior if they achieved the response the KD-A8 has at -20dB rather then the 0dB level at which we ran our tests.

Signal-to-noise ratio with respect to the 0dB playback level was measured for both the TDK-SA tape and the Maxell metal tape. With ANRS noise reduction the unweighted figures were 54dB for the metal tape and 52dB for the TDK-SA, and DIN weighted the figures were respectively 56dB and 57dB. Without the ANRS noise reduction system the unweighted noise figure dropped to 48dB in both cases, which means that the ANRS system affords an improvement of 4dB for the TDK and 7dB for the Maxell tape.

These are quite good noise S/N ratios. It is not unusual for some S/N ratio tests to be made with respect to a signal which produces 3% third harmonic distortion, which at least in the case of the TDK-SA leads to a further 3dB improvement in the S/N ratio. For a metal tape the improvement would be even greater because of the greater dynamic range.

Wow and flutter was excellent — in fact it was the best we have measured. Using the Maxell metal tape we obtained a figure of 0.05% DIN weighted. Harmonic distortion and noise at -10VU with Super ANRS was 1% at 1kHz for the TDK-SA tape, rising to 2% at 10kHz. The Maxell metal tape gave a distortion and noise figure of 0.8% at 100Hz 1% at 1kHz and 1.8% at 10kHz.

Subjectively, the KD-A8 sounds superb. We recorded a number of different musical passages and then AB compared the playback with the original record, with the result that the two were virtually indistinguishable except for a slight background noise from the deck.

It would be difficult to exceed the sort of performance JVC have obtained with their BEST and ANRS systems without a similar computer-based optimisation system and compander, so it seems that in future we will certainly be seeing a lot more of microprocessors in top line cassette decks.

Recommended price of the KD-A8 is $899 including sales tax. Further inquiries should be made to high fidelity retailers or the distributors for JVC, Hagemyer (A/Asia) BV, 25 Paul St, North Ryde, NSW. (R. de J.)

Delay system for car courtesy lights

Build this simple circuit for your car

How about this for a neat automotive circuit? When fitted to the interior lighting circuit of your car, it will delay the turn-off of the courtesy lights for a set period after the door closes. It's easy to build, all on a small PC board, and can be fitted to most cars.

by GREG SWAIN

Conjure up in your mind the following fantasy. You've just left an exclusive nightclub on the foreshores of beautiful Sydney harbour. Her expensive French perfume wafts balmily on the still summer night air. You open the door to the Mercedes and she slides into the imported lambswool-covered seat. You shut the door ... and the courtesy light stays on!

You've now got all of 20 seconds to stroll suavely round to the other side of the car before the courtesy lights go out. Just think how impressed she'll be when the lights automatically fade as you drive off.

Whoa! . . . steady on. Let's get back to reality. Let's discuss some of the more down-to-earth uses of a courtesy light delay! . . .

While courtesy lights provide a welcoming sight when a car door is opened at night, the effect is spoiled immediately one enters the car and pulls the door shut. The light goes out just when you need it to find and fasten the seat belt, identify the ignition key, and locate the ignition lock. Most people (including me) have six or seven keys on the key ring, and finding the ignition key in the dark can be a "real pain".

Of course, there is an internal switch for the courtesy lights, but finding it can be just one more problem in the dark. Think how much nicer it would be if the courtesy lights stayed on long enough to get yourself settled.

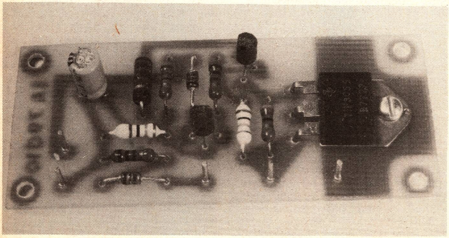
Such a feature would be even more valuable when ushering a guest into your car. The internal switch is seldom accessible from the passenger side of the car, so you have no option but to plunge the car into darkness as the door closes, leaving the guest to fumble for the seat belt in the dark until the driver's door is opened.

This simple circuit overcomes these problems by holding the courtesy lights on for a fixed period after the car door has been closed. As shown, the circuit provides a delay time of approximately 20 seconds, although this can easily be varied to suit the constructor. At the end of the delay period, the lights automatically fade out.

With a simple type of delay circuit, choosing a suitable delay time involves a compromise. If the period chosen is too short, you do not have time to settle in properly; if it is too long, the lights will still be on when you are ready to drive off. While this latter situation is of no consequence during daylight hours, it could be a problem at night.

This leads us to the next feature provided by our delay circuit. The circuit has been designed to interconnect to the headlight switch so that the courtesy lights are switched off automatically whenever the headlights or parking lights are turned on. With the headlight interlock arrangement, the delay time is no longer critical. It can be extended to one minute or more if you so wish.

We found a delay time of 20 seconds to be the best compromise. It provides ample time to get settled in the car, and yet doesn't keep the courtesy lights on for an inordinately long period after the driver leaves the vehicle. It also turns the lights off after a reasonably short period when driving off during daylight hours.



Larger than life size photo of the assembled PC board. A small flag-type heatsink should be fitted to the TIP3055 transistor for loads exceeding 30W.

We estimate that the current cost of parts for this project is approximately

$5

including sales tax. This does not include the cost of miscellaneous items.

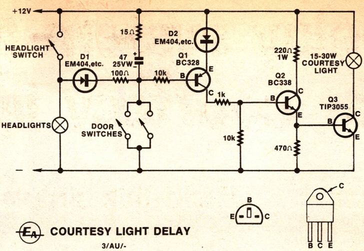
PARTS LIST

1 TIP3055 NPN transistor
1 BC338 NPN transistor
1 BC328 PNP transistor
2 IN4001 or similar silicon power diodes
1 47uF/25VW electrolytic capacitor
1 PCB, 87 x 38mm, code 79d10
5 PC pins

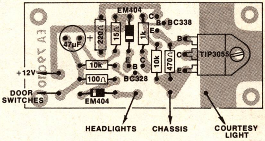
RESISTORS
¼ or ½ watt unless specified
1 x 15 ohm, 1 x 100 ohm, 1 x 220 ohms 1W, 1 x 470 ohms, 1 x 1k, 2 x 10k

MISCELLANEOUS
Hookup wire, 3A fuse and fuse-holder, stand-off pillars, machine screws and nuts, automotive connectors, etc.

Note: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may generally be used provided they are physically compatible.



The circuit uses three low-cost transistors and provides a delay time of approximately 20 seconds. The delay time can be altered by changing the 47uF electrolytic capacitor (see text).



The component overlay diagram. Make sure that all polarised components (transistors, diodes, capacitor) are inserted the right way round.

HOW IT WORKS

Refer now to the circuit. It's really very simple, and uses just three transistors and a handful of other components. It works as follows:

Assuming initially that all switches are open and that the 47uF electrolytic capacitor is discharged, there will be no forward bias on the base of Q1 and no collector current through this transistor. This, in turn, means that both Q2 and Q3 are also held off because Q2 receives no forward bias from Q1.

The 10k and 470 ohm resistors in the base circuits of Q2 and Q3 respectively ensure that these transistors are held completely off, in these conditions.

When one of the door switches is closed (ie, the car door is opened), the 12V supply is connected to the 47uF capacitor via a 15 ohm resistor. The purpose of the resistor is simply to limit the initial charging current through the capacitor to a reasonable level and prevent damage to the door switches. In spite of it, the capacitor charges almost instantaneously.

Regardless of the time needed for the capacitor to charge, Q1 is forward biased immediately the switch closes due to the very low internal impedance of the battery. Initially, the full voltage appears across the 15 ohm resistor then, as the capacitor charges, progressively across the latter until it is fully charged.

With forward bias applied, Q1 conducts, turning on Q2 and Q3 and switching on the courtesy light. When the door switch opens the charge on the 47uF capacitor maintains the forward bias on Q1 until it is discharged. When the capacitor discharges the forward bias to Q1 is removed, Q2 and Q3 turn off, and the courtesy light goes out.

So long as the headlight switch remains open, the capacitor can discharge only through the 10k resistor and the base/emitter junction of transistor Q1. It cannot discharge through the 100 ohm resistor and the headlight circuit because diode D1 is reverse biased. With the capacitor value shown, the courtesy lights should remain on for about 20 seconds.

The delay time can be altered simply by changing the value of the capacitor. As you may expect, the relationship between capacitance and delay time is linear. To increase the delay time to 40 seconds, for example, all you have to do is double the value of the capacitor — 100uF is the nearest preferred value.

Similarly, the delay time can be decreased by decreasing the capacitor value.

Diode D1 and its associated 100 ohm series resistor form the headlight interlock circuitry. If the headlights are turned on during the delay time, diode D1 becomes forward biased and provides a low resistance discharge path for the capacitor which discharges almost instantaneously. The 100 ohm resistor limits the current through the diode to a safe value.

The reason for the inclusion of diode D2 will not be obvious at first glance. Basically, it has been included to ensure that Q1 and the other transistors turn off completely once the 47uF capacitor is discharged.

Because of the presence of D1, the headlight switch cannot discharge the 47uF capacitor below the forward conduction voltage of the diode, about 0.6V. In practice it can be higher than this due to voltage losses along the headlight lead wiring, depending on where the circuit is tapped into the car's electrical system. Thus it could be that the headlight interlock circuit may not discharge the capacitor below 0.8V or even 1V, at which level it is still capable of holding Q1 in conduction, albeit at a low level.

While the capacitor will discharge eventually the courtesy lights would not go out immediately as required. Diode D2 overcomes this problem. By including it in the emitter circuit of Q1, the voltage required to forward bias the transistor is raised by the junction voltage of the diode (0.6V approx). This means that the voltage at which the transistor will cease conducting is raised to about 1.2V.

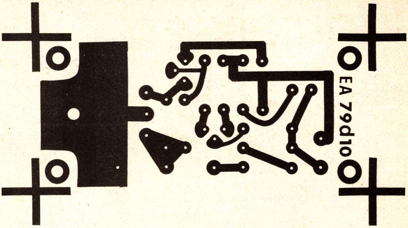
CONSTRUCTION

Construction should present no difficulties, even for the beginner. The circuit is all contained on a small printed circuit board measuring 87 x 38mm and coded 79d10. Assemble all of the components onto the board as shown in the overlay diagram, making sure that you insert the transistors, diodes and electrolytic capacitor the right way round. We used PC stakes to facilitate external connections to the board.

No heatsink is required for the TIP3055 power transistor, at least not for loads up to 30W. The saturation voltage of Q3 is quite low at about 0.2V, so that even when connected to a 30W load the transistor only has to dissipate 0.5W. You should find that for loads of less than 30W, the TIP3055 will run slightly warm to the touch, even when the car door is held open for extended periods.

Note that Q3 should be mounted flat against the PC board and secured with a small machine screw and nut. A modest amount of heatsinking is provided by the copper pattern on the reverse side of the board.

Note also that the circuit can be operated with loads exceeding 30W, provided that Q3 is fitted with an adequate heatsink. For loads up to about 45W, a small flag-type heatsink should suffice.



Actual size reproduction of the PC artwork.

Fitting an extra unit of any kind to a car often involves as much or more effort as making the unit, particularly if one is not familiar with the wiring. However, in this case the job should not be too difficult.

The leads from the door switches are usually found coming over the top of the trim panels forward of the front doors, while the courtesy light lead(s) are usually run up the inside of the windscreen pillar. Assuming that the headlight switch can be easily removed, connections to the headlight circuit are most logically made direct to the switch terminals.

Make sure that the +12V supply is derived from the active side of the switch.

In some cars, however, removal of the headlight switch can be a major undertaking. If this is the case, the +12V supply can be picked up from the fuse panel and the connection to D1 picked up from the headlight dipper circuit. A 3A fuse should be included in the positive supply line to provide protection in the event of circuit malfunction, and all connecting wires should be of reasonably heavy current capacity. Use 23 x 0.19mm cable or heavier.

As to the best place to mount the PC board, that will largely depend on the type of car you own. The most obvious place is somewhere under the dashboard or, alternatively, on the firewall.

Having completed the installation, the unit can be given a final checkout. Check to see that the courtesy lights go out at the end of the delay time, that they go out immediately the headlights are turned on, and that the courtesy light switch on the dashboard still functions in the normal way. You should also check the temperature of the TIP3055 power transistor after the car door has been left open for an extended period, say five or 10 minutes. If it becomes too hot to touch, it should be fitted with a heatsink.

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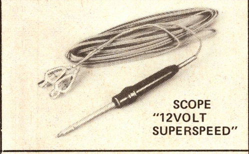
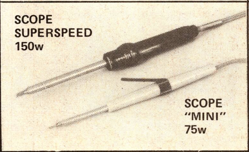
● 12 volt. Battery power available only. ● Outdoor and bad weather expected. ● Service vehicle can get within 6 metres.	 SCOPE "12VOLT SUPERSPEED"	1. 5 Second heating. 2. 200 watts if needed. 3. Controllable temperature. 4. You can replace tip or element anywhere in minutes.
● Modern sophisticated PCB equipment. ● Accurate & automatic temp. control wanted. ● Components are heat critical.	SCOPE "TC60"	1. Heats in 45 seconds. 2. Dial any temp. 200°–400°. 3. Plugs direct to mains. No transformer needed. 4. Accept iron plated tips from 0.8mm to 6.4mm.
● Unpredictable soldering situation. ● Maybe electrical or electronic or mechanical. ● You can't come back to base for a bigger or smaller iron.	 SCOPE SUPERSPEED 150w SCOPE "MINI" 75w	1. 5 second heat up. 2. Controllable temperature. 3. Reserve heat for any normal job. 4. 4 volt safety in the hand.

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Take the guesswork out of exposure settings!

Exposure Meter for Electronic Flash

In recent months we have produced two very useful accessories for photographers in the form of Light-activated and Sound-activated triggers for electronic flash. But now we have produced a unit which easily surpasses these in appeal: a flash exposure meter. This is comparable with commercial units but you can build it for a fraction of the price.

by IAN POGSON

While the Light-activated and Sound-activated triggers for electronic flash have been very favourably received by amateur photographers who have an interest in electronics, our most common request from these people has been for a circuit for an electronic flash exposure meter. Now, after much trial and error, we have come up with a circuit that we are very proud of.

Keen photographers are only too aware of the fact that when using electronic flash, correct film exposure is often a hit-or-miss afair. While the exposure tables provided with most electronic flash guns are a pointer in the right direction, they are, at best, only a rough guide. And they are of no use for outdoor flash photography or in situations where two or more flash guns are used.

Here is where the flash exposure meter comes in very handy. Just set it up at the position of the subject to be photographed, set the moveable scale to the film ASA rating and pop the flash gun(s). Presto, the meter reads the light value and holds it for you until reset. Then you can read your exact exposure off the moveable scale.

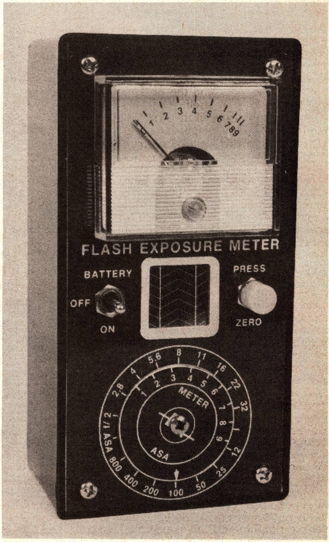
Commercial flash exposure meters range in price from $100 up to $150 or more. Our unit can be built for less than $40. What a bargain!

Now let us have a look at the circuit: While it looks fairly complicated it is really quite simple and uses just a handful of components. The heart of the unit is a silicon photovoltaic cell, identical to the cell used in our Light-activated trigger, described in the October issue.

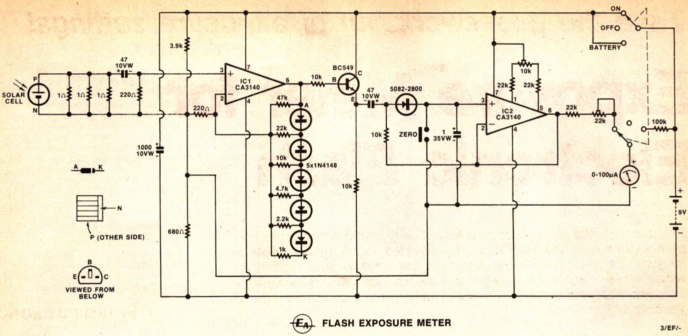
The silicon cell is ideal for the job because it has an extremely fast response time which is necessary to cope with the very brief and intense burst of light from typical flash guns. In other respects, the silicon cell is not ideal because it is really a light-to-charge transducer whereas we need a light-to-voltage conversion.

To obtain this characteristic, the silicon cell is loaded with a combination of three one-ohm resistors in parallel. This is workable because the silicon cell has a very low output impedance. The loaded output of the cell is AC coupled via a 47uF capacitor to a CA3140 op amp, AC coupling serving to eliminate any initial output of the cell due to ambient light. The mosfet-input 3140 op amp is used not because of its high input impedance but because of its high "slew-rate"— necessary to match the fast response of the silicon cell.

The 3140 op amp is arranged as a DC amplifier with a weird-looking feedback network made up of diodes and resistors. This is to provide the amplifier with a logarithmic response, which is necessary to compress the wide range of useable light values to a readable meter scale.



Handsome is as handsome does! Our new Flash Exposure Meter looks the part and takes the guesswork out of exposure settings. Here it is shown roughly full size.



That string of diodes makes the response of IC1 logarithmic in order to handle a large range of light values.

An NPN transistor connected as an emitter-follower is used to buffer the output of the first 3140 op amp. This is necessary because the very fast pulse delivered by the op amp has to be stored in a capacitor and the op amp cannot do the job by itself.

The buffered output of the first 3140 amplifier is fed to a "sample and hold" circuit via a 47uF capacitor. This sample-and-hold circuit consists of a diode, a 1uF capacitor and a second 3140 amplifier which is used, this time, for its extremely high input impedance. The diode is a "hot carrier" type made by Hewlett-Packard. This is specified because of its low forward-conduction voltage and very low reverse leakage.

The 3140 op amp is connected as a "voltage follower". This means it has unity gain and as a result, as is indicated by the name, it produces an exact replica of its input at the output. The output of the amplifier is used to bootstrap the hot-carrier diode via a 10k resistor. This largely cancels out the very low leakage in the hot-carrier diode and means that the "sample and hold" circuit really does what it is supposed to — hold the value.

The voltage-follower has an offset voltage adjustment (the 10k trimpot) so it can be effectively zeroed. The output is fed to a 100uA meter movement via a series 22k resistor and 22k trimpot.

A momentary-contact pushbutton switch is connected across the 1uF sample-and-hold capacitor to discharge it before each reading is made.

Both op amps require positive and negative supplies and this is provided by "splitting" the nine volts from the battery with a voltage divider consisting of a 3.9k and 680-ohm resistor. This uneven division gives a higher value for the positive rail than for the negative. This is desirable to give the best possible signal handling for the positive pulse from the silicon cell.

On casual inspection it may appear that the polarity of the second 47uF, at the output of the emitter-follower, is incorrectly marked on the circuit diagram. It is correct. By virtue of the fact that both op amps have their outputs set at the reference potential provided by the above-mentioned voltage divider, then the emitter of the BC549 is actually 0.6 volts below this reference potential.

The diode side of the capacitor is held at reference by the bootstrapping 10k resistor, so this side is positive with respect to the BC549 emitter.

We estimate that the current cost of parts for this project is approximately

$38.00

This includes sales tax.

A 1000uF capacitor is connected across the battery to ensure a low impedance supply. The circuit allows reasonable accuracy to be maintained until the battery drops below 7 volts. This means that the battery life should be quite long, in line with the intermittent use of the unit. The on-off switch has a battery check position, so you are unlikely to be caught out with a flat battery.

Well that completes the circuit description but before touching on constructional details, perhaps a few comments on some of the components may be helpful. The very important silicon solar cell may not be available from all stockists but we have used cells from Dick Smith Electronics and David Reid Electronics and both are quite suitable for the Flash Exposure Meter; both are 20mm square. They differ slightly in appearance, particularly in the pattern of the electrodes on the front face. The unit sold by Dick Smith does not have any leads attached but the unit from David Reid has two thin foil strips for connection to the external circuitry. More will be said about installing the cell later on.

The meter which we used is sold under the University brand and was supplied by Radio Despatch Service. Other brands of meter may be used, provided they are 100uA FSD and are physically compatible.

The plastic box which houses the unit is available from Dick Smith Electronics and Radio Despatch Service and may also be available from other sources. The PCB should be available from all the usual suppliers of boards by the time this appears in print.

The front panel, rotor for the calculator and the meter scale were made up by the "Scotchcal" process. This gives quite a good professional finish. Radio Despatch Service are making Scotchcal duplicates of these items available for readers making this and other projects. Also, we understand that special meter scales are to be made available for University meters. These will also be available from Radio Despatch Service.

Although the unit is a small one, construction does call for some special care, particularly when handling the solar cell and the two ICs. The usual care should also be taken when soldering, to make good joints and to avoid overheating any components. It is also important to make sure that the ICs, transistor, capacitors, diodes, battery and the solar cell are correctly polarised.

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HEATH
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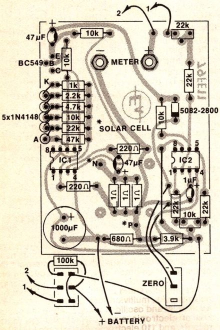
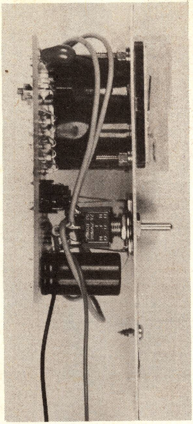
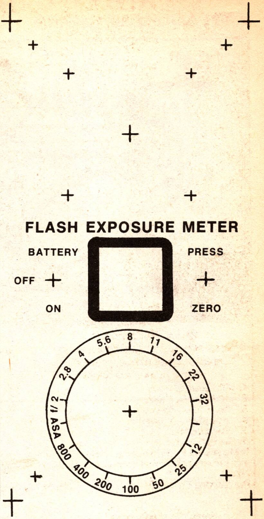
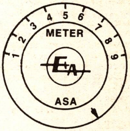


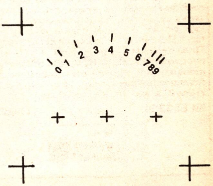


This wiring diagram and internal photo show most of the details of assembly.





Shown in this column is the full-size artwork for the front panel and meter scale.



The PCB may be assembled by making reference to the overlay diagram. As usual, the smallest components should be fixed first, starting with the jumper wire and resistors, followed by the diodes, capacitors etc. While it is quite in order to solder the ICs directly onto the board, I favour the use of sockets. If you should decide to solder the ICs straight in, make sure that the barrel of the soldering iron is connected to the negative supply line of the PCB, via a clip lead.

That part of the construction which demands the maximum care is mounting the solar cell on the board. The cell must be stood off the PCB so that when the whole unit is assembled, the cell is just beneath the front panel opening. To do this, we used two pieces of 26 gauge tinned copper wire. The two pieces were bent in the form of a "U", with sharp corners. The dimensions are such that the middle part of the wire is a little shorter than the metal backed dimensions of the cell. As the cell will need to be about 26mm from the board, the "legs" should be left a few millimetres longer than this for the time being.

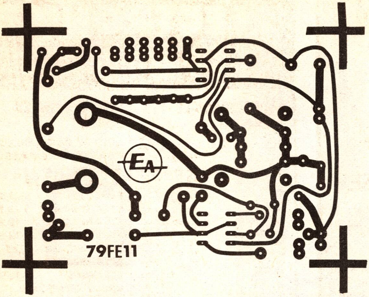
The distance between the four legs should be made to match the mounting holes provided on the PCB. The dimension 26mm, should be considered as a tentative one until the final assembly into the box.

If you get a solar cell with flying leads, then the one connected to the metal backing plate should be removed before adding the "U" pieces previously mentioned. The second flying lead may be soldered to a short piece of wire soldered to the respective point on the PCB. When no flying leads are provided, the connection to the front of the cell may be made with another piece of 26 gauge tinned copper wire straight from the PCB.

Great care must be taken with the foregoing operation, as any rough or careless handling may result in fracture of the cell.

With all the components fixed on the board, before it is ready to be fitted into the box, leads for the switches and the battery must be added. Also, the 100k battery metering resistor should be connected to the three position toggle switch.

To protect the solar cell from possi-



An acutal-size reproduction of the PCB artwork.

PARTS LIST

1 Plastic box 130mm x 68mm x 41mm
1 Front panel and cursor (see text)
1 PC board 76mm x 59mm code 79FE11
1 9V battery No. 216
1 Meter 100uA 48mm x 42mm with special scale
1 Solar cell 20mm square (see text)
1 Switch push-button SPDT
1 Switch double pole 3-position toggle
2 CA3140 ICs
2 IC sockets 8-pin DIL
1 BC549 transistor
1 5082-2800 hot-carrier diode
5 1N4148 silicon diodes
1 1uF/35VW tantalum
2 47uF/10VW tantalum
1 1000uF/10VW electrolytic
1 10k miniature vertical trimpot
1 22k miniature vertical trimpot

Resistors (all ½W or ¼W)
3 1 ohm
2 220 ohms
1 680 ohms
1 1k
1 2.2k
1 3.9k
1 4.7k
4 10k
4 22k
1 47k
1 100k
Hookup wire, solder, 26 gauge TC wire, battery clip and leads.

NOTE: Ratings are those used on the prototype. Components with higher ratings may generally be used providing they are physically compatible. Components with lower ratings may also be used in some cases, provided the ratings are not exceeded.

ble damage later on, it is wise to give it some protection by cementing a piece of clear plastic, or even a thin piece of glass, over the cutout for the cell and at the back of the board. The thickness of this material will determine whether any adjustment has to be made to the cell mounting previously referred to.

The rotor for the calculator has to be positioned on the front panel. We will assume that you have the front panel and cursor made from Scotchcal and that the piece has already been fitted to the panel. The cursor has to be cut out to a circle and this can be conveniently done with a pair of scissors and a little care. This done, a clearance hole is drilled in the exact centre of the rotor. The corresponding hole on the panel will be of a suitable size for the method of mounting. We used a self-tapping screw, with a washer between the panel face and the rotor, with the screw tightened just so that the rotor can be conveniently turned with the fingers.

To complete the assembly. the two switches and the meter are fixed to the front panel and the PCB is fixed to the panel assembly by means of the two meter terminals. The leads between the PCB and the switches and battery are now connected. The complete assembly is ready to be fitted to the box but before doing so, the matter of calibration has to be considered.

The way calibration is to be done will depend upon available facilities. We calibrated the prototype against a professional unit known to be accurate. This is also how we arrived at the various calibration points for the scale.

Calibration may be done by a series of steps. First, make sure that the meter is accurately set to its mechanical zero before the unit is switched on. Switch on the unit and press the zero button. Adjust the zero offset 10k potentiometer so that the meter again reads zero. The final step is to adjust the 22k potentiometer in series with the meter for a scale reading of eight or nine against whatever reference may be available.

If you are fortunate enough to have access to a commercial flash meter of known accuracy, then the job is an easy one. The two meters should be placed together, zeroed and a flash gun discharged to give an eight or nine reading on the reference meter. The 22k potentiometer should then be adjusted to give a similar reading on the meter being calibrated.

Some flash exposure meters are calibrated directly in stop values rather than the naught to nine numbering system. If this is the case, then an indirect approach will need to be taken. Set both meters to say, 50 ASA. The scale on your new meter indicates that a stop between f/22 and f/32 corresponds to a meter reading of eight. A flash giving these values should be aimed at.

Most readers will not be able to calibrate against another flash exposure meter and so other means will have to be adopted. Perhaps the most readily available method is to calibrate at least tentatively against the table or calculator of the flash gun to be used with the meter.

The flash gun should be discharged at a fairly close range from the flash exposure meter and the 22k potentiometer should then be adjusted to make the meter agree with the flash gun's table or calculator. This step should be carried out indoors in a typical room to take account of the fact that the guide table on a flash gun is a compromise for this situation.

Whatever calibrating method is used, it will have to be evaluated by actual use and the exposure results which are obtained. It may be necessary to make a further adjustment to the 22k potentiometer, or the arrow for the ASA scale may need to be moved to suit.

Well, that about wraps it up. We are sure that anyone who builds this flash meter will be very pleased with the final result. It works well and looks the part!

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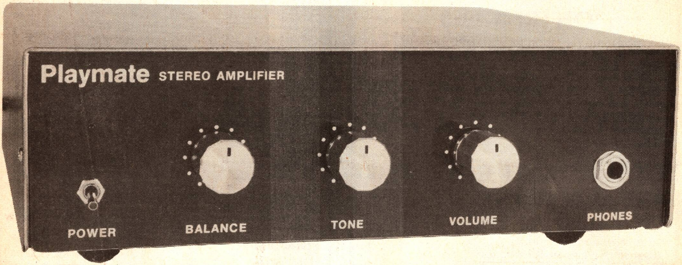
Playmate 3W + 3W stereo amplifier

. . . a lot of fun for little outlay



Introducing Playmate for January, and for all the other months of the year. Playmate is a low cost stereo amplifier which will team with record changers having ceramic or crystal cartridges. It drives loudspeakers of reasonable efficiency to more than adequate levels and produces good quality sound. It is just the ticket for a second low-cost system for the children or as a beginner's first system.

by JOHN CLARKE

Playmate is housed in a compact steel chassis with a black Marviplate cover. It has volume, tone and balance controls and a headphone socket. On the rear panel it has spring-loaded terminals for connection of loudspeakers and a mains fuse. Simplicity and low cost are the keynotes of the design. All components are readily available and the amplifier can be put together in just a few hours.

The Playmate stereo amplifier can typically be used with loudspeakers of any size with 4, 8 or 16 ohms impedance and preferably of high sensitivity. It is NOT suitable for use with compact loudspeaker systems of notably low efficiency.

A glance at the specification panel will show that the Playmate offers a fine performance which will more than match the record players and loudspeakers it is likely to be used with. It has low distortion, excellent signal-to-noise ratio and wide frequency response.

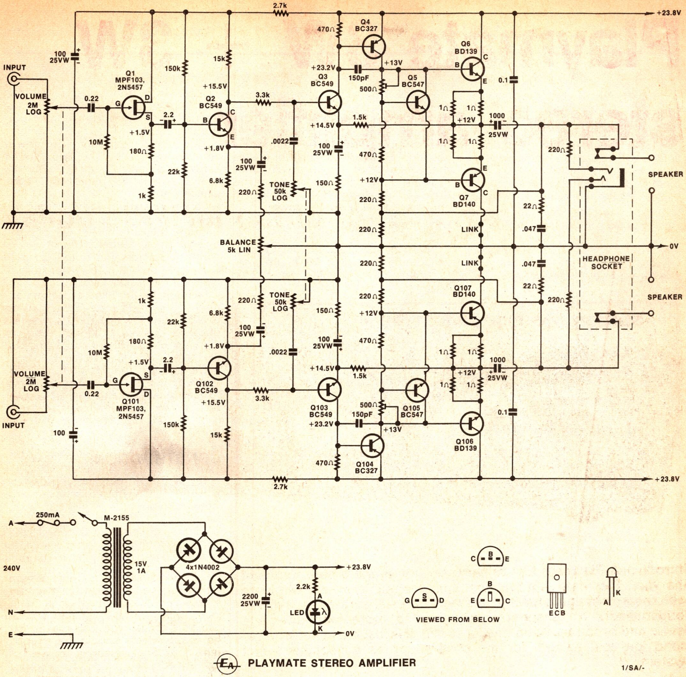
Power output on music signals is typically three watts per channel, which was typical of commercial stereograms and players which were manufactured on a wide scale in Australia a few years ago. This order of power, together with the necessary gain and high input impedance, is obtained with seven low-cost transistors in each channel.

Let us now discuss the circuit, starting from the input. The Playmate stereo amplifier has a high input impedance to enable good bass response to be achieved with typical ceramic and crystal phono cartridges. The maximum output voltage of a cartridge may vary from a few hundred millivolts for a good quality ceramic type to several volts for a crystal type. This means that the input system should have good signal handling capability as well as high impedance.

For this reason, the volume control is placed right at the input, which means that the input overload capability is virtually infinite. This can be said because, with a volume control at the input of an amplifier, the amplifier output stages should overload well before the input stages.

The 2-megohm volume control is followed by a field-effect transistor (FET) connected as a source-follower. This has a bootstrapped input bias resistor to keep the loading effects of the FET stage to an absolute minimum and ensure that the input impedance of the amplifier is very close to 2 megohms, regardless of the setting of the volume control.

The voltage gain of the FET stage is less than unity, typically about 0.7. This is really a loss of signal rather than gain so the following stages have to provide a little extra gain. Output from the FET source is AC-coupled to a common-



The circuit diagram shows both channels of the new amplifier.

emitter amplifier using a BC549 silicon transistor.

As well as providing gain, this stage also provides the Balance control function. This consists of a 5k potentiometer with its wiper connected to the 0V line and each arm connected to the emitter of Q2 in each channel.

Changing the setting of the Balance control has the effect of altering the AC impedance at the emitter of Q2 in each channel and thereby changing the gain. This type of Balance control has a limited range compared to that found in more pretentious amplifiers, where the Balance control can usually cut off either channel. In fact, the range available is more than adequate for normal use.

TONE CONTROL

Following the Balance control stage is a passive tone control which provides a maximum treble cut of -12dB at 10kHz. The tone control works by voltage-divider action at high frequencies; the ratio between the resistance of the 50k potentiometer and the series 3.3k resistor determines the amount of attenuation. The slope of attenuation is 6dB/octave.

Q3, Q4, Q6 and Q7, together with their associated components, form a simple direct-coupled amplifier. The output transistors, Q6 and Q7, are connected in complementary-symmetry class-B configuration.

As with class-B amplifiers intended for audio work, the output transistors are run with a small quiescent current to minimise cross-over distortion. This current is set and stabilised by Q5.

Q5 is commonly referred to as a "Vbe multiplier". This is because the collector-emitter voltage is defined by the ratio of the resistance between base

We estimate that the current cost of parts for this amplifier is approximately

$49

This includes sales tax.

and emitter to the resistance between collector and base. In this case, the 500 ohm potentiometer is used to set this ratio to approximately two. This means that the voltage between collector and emitter will be approximately twice the base-emitter voltage which is 0.6 volts (nominally). Thus the collector-emitter voltage would be about 1.2 volts.

In practice, the collector-emitter voltage of Q5 will be closer to 1V which is just enough to provide a slight forward bias for the output transistors, Q6 and Q7, so that the quiescent current is just a few milliamps.

Voltage drive to the complementary emitter-followers Q6 and Q7 is provided by driver stage Q4 which is a common-emitter amplifier stage. Bootstrapping from the output is applied to the collector load of Q4 (to the junction of the two 220 ohm resistors). This technique increases the drive available from Q4 and enables the amplifier to deliver more power.

VOLTAGE AMPLIFIER

Ahead of the class-A driver Q4 is a voltage amplifier stage, Q3. Input signal to Q3 is direct-coupled via a 3.3k resistor from the collector of Q2. Negative feedback is applied to the emitter of Q3 from the amplifier output.

The overall gain of the power amplifier is set by the two emitter resistors connected to Q3. For the values specified, 150 ohms and 1.5k, the gain is about 11.

To ensure stability at supersonic frequencies, a 150pF capacitor was added between the collectors of Q3 and Q4. In addition a "Zobel" RC network is connected across the output to help cope with the highly reactive nature of typical loudspeaker loads.

Incidentally, the 100uF capacitor connected from the negative rail to between the 2.7k and the 15k resistors provides essential decoupling to minimise hum injection into the base of Q3.

The power supply is quite straightforward. It uses a transformer with a 15V secondary winding to feed a bridge rectifier and 2200uF filter capacitor. A light-emitting diode functions as a pilot light.

CONSTRUCTION

Let us now discuss the construction of the Playmate stereo amplifier. It is housed on a simple dish chassis with a wrap-over cover. All the circuitry is accommodated on a PCB coded 80sa3 and measuring 175 x 107mm. The layout of the PCB is such that the two channels are separate. It is possible to cut off the left-hand section if a mono-only amplifier is required.

Assembly of the PCB can begin by mounting the resistors, diodes and other small components first. Follow the wiring diagram and PCB component layout carefully when mounting polarised components such as diodes, electrolytic capacitors and transistors. The last components to be soldered in are the power transistors. These need to be mounted on the underside of the PCB so they can be attached to the chassis.

Although two one ohm resistors are specified for each of the power transistor emitter resistors, it is possible to use 0.47 ohm 1W resistors instead, if these are on hand.

The power transistors should be mounted such that the leads just emerge from the top of the board. Insert the board supports in the holes provided on the PCB then manipulate the transistors so that their metal faces are at the same level as the board supports and the mounting holes of the transistors are aligned with those on the chassis. You will have to temporarily install the PCB in the chassis for this procedure.

PERFORMANCE OF PROTOTYPE

POWER OUTPUT

	One channel	Both channels
4 ohms	4.0W	3.1W
8 ohms	2.8W	2.0W
16 ohms	1.3W	1.3W

DYNAMIC HEADROOM

4.9dB (for 8 ohm loads)

FREQUENCY RESPONSE

-1dB at 45Hz and 20kHz

CHANNEL SEPARATION

-55dB with 4.7k source impedance
-35dB with typical ceramic cartridge as source

INPUT SENSITIVITY

100mV RMS for full power into 8 ohm loads

INPUT IMPEDANCE

2 megohms approx.

BALANCE CONTROL RANGE

+14dB, -4dB in both channels

TONE CONTROL

-12dB at 10kHz; 6dB/octave slope

HUM & NOISE

-55dB unweighted with 4.7k input source and with respect to full power into 8 ohms

TOTAL HARMONIC DISTORTION

typically 0.5% or less (see graph)

STABILITY

unconditional

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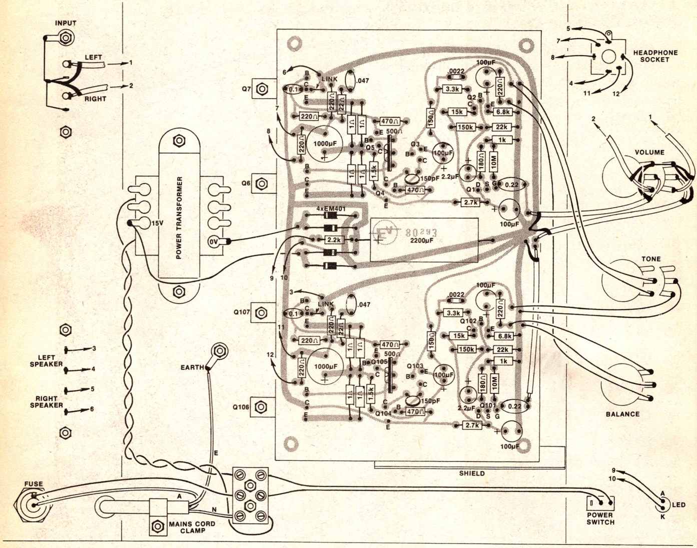


The wiring diagram for the Playmate stereo amplifier. Note the metal shield between the on/off switch and the PC board.

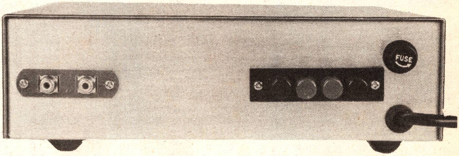
We recommend the use of PC pins or stakes to facilitate connections between the PCB and the potentiometers and other components in the chassis.

With the PCB complete put it aside and work on the chassis. Install all the hardware such as transformer, potentiometers, input sockets, output terminals and so on. A metal screen is also installed, to shield the amplifier input wiring from the mains switch wiring. This screen should be supplied as part of the metalwork.

With all the hardware installed, the mains wiring may be run. Here the wiring diagram should be followed exactly, for safety's sake.

The next step is to attach leads to the board for ultimate connection to the controls, transformer and loudspeaker output terminals.

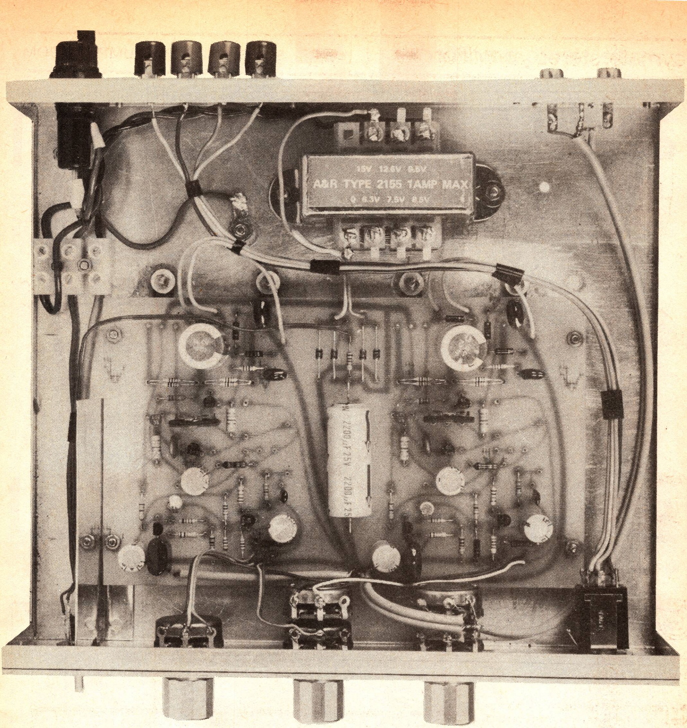
The leads to the balance and tone control should be kept as short as possible and "rainbow" cable is recommended both for a neater appearance and to aid lead identification.



Above is the rear of the chassis. The input terminals are at left, while the loudspeaker terminals and fuse are adjacent to the mains cord at right.

Screened cable should be used for the connections from the input to the volume control and then to the PC board. A screened cable is also used for the left hand channel input along the PC board.

After all the external leads have been



Inside the completed prototype. Some minor changes were made to the PC board after this photograph was taken.

attached, insert the board supports into the chassis and prepare to anchor the output transistors. This should be done by first sticking the TO-126 mica washers in place with heatsink compound then securing the transistors each with a screw and nut. Insulating bushes are not necessary to mount the transistors since a plastic bush is part of the transistor case.

The power transistors should be isolated from the chassis, but don't take it for granted. Check by disconnecting the phono inputs from the chassis and testing with a multimeter for continuity between the chassis and any part of the circuitry. If a short is discovered, unbolt the transistors one at a time until the short is removed; then take appropriate action.

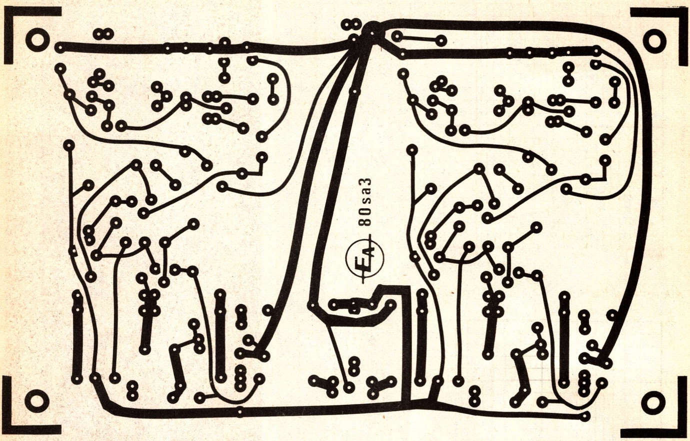
Before wiring up the spring loaded speaker sockets, swap two of the terminals around so that the two active (red) terminals are in the middle. This reduces the risk of accidental shorts to chassis or negative terminals.

Now apply power and check all voltages shown on the circuit. The values you obtain should be within about 10% of these shown on the circuit. That being the case, you are now ready to adjust the quiescent current through the output transistors in both channels.

QUIESCENT CURRENT

The quiescent current can be adjusted in two ways. If you have a digital voltmeter which can accurately measure voltages of 10 millivolts or less, then the quiescent current may be measured by checking the voltage between the emitters of Q6 and Q7.

If you have a conventional multimeter which will measure down to a few volts or so, a different approach is required. Here, a 220 ohm resistor is inserted in series with the collector of the



Here is an actual size reproduction of the PC artwork.

Parts list for the Playmate stereo amplifier

CHASSIS & HARDWARE

1 chassis and cover, 230 x 68 x 210mm (W x H x D)
1 PCB, code 80sa3, 175 x 107mm
1 front panel
3 knobs to suit front panel
1 power transformer, A&R 2155, DSE 2155
1 miniature SPST toggle switch
1 6.5mm stereo jack socket with switch contacts
1 LED for pilot light
1 5k (lin) potentiometer
1 50k (log) dual ganged potentiometer
1 2M (log) dual ganged potentiometer
4 PC board standoff supports (6mm)
1 3AG bayonet screw type fuse holder
4 rubber feet
2 solder lugs
1 mains cord clamp and grommet
1 3-way insulated terminal block
1 3-pin mains plug and three core mains cable
1 2-way RCA phono socket panel
1 4-way spring-loaded terminal panel
½ metre of 10 conductor rainbow cable
½ metre of figure-8 shielded cable
4 sets of mounting hardware for TO-126 power transistors; ie, mica washers plus screws and nuts
1 250mA 3AG fuse

SEMICONDUCTORS

4 1N4002 or 100PIV 1 amp silicon diodes
2 2N5457 or MPF103 N-channel FETs
4 BC549 NPN low noise transistors
2 BC547, NPN transistors
2 BC327 PNP transistors
2 BD140 PNP power transistors
2 BD139 NPN power transistors

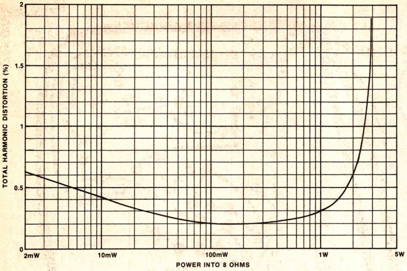
CAPACITORS

1 2200uF/25VW pigtail electrolytic
2 1000uF/25VW PC electrolytic
6 100uF/25VW PC electrolytic
2 2.2uF/16VW PC electrolytic
2 0.22uF polyester film
2 0.1uF polyester film
2 0.047uF polyester film
2 0.0022uF polyester film
2 150pF ceramic

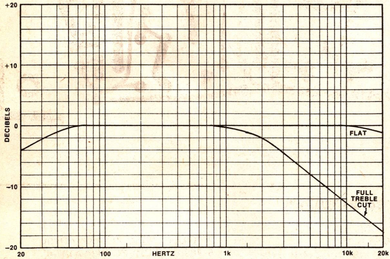
RESISTORS

(5% tolerance ¼W unless otherwise noted)
2 x 10M, 2 x 150k, 2 x 22k, 2 x 15k, 2 x 6.8k, 2 x 3.3k, 2 x 2.7k, 1 x 2.2k, 2 x 1.5k, 2 x 1k, 4 x 470 ohms, 10 x 220 ohms, 2 x 180 ohms, 2 x 150 ohms, 2 x 22 ohms, 8 x 1 ohm ½W, 2 x 500 ohm preset potentiometers.

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may generally be used provided they are physically compatible.



Above: total harmonic distortion is typically less than 0.5%.



This graph plots the response of the amplifier with the tone control flat, and with full treble cut. Maximum treble cut is around -12dB at 10kHz.

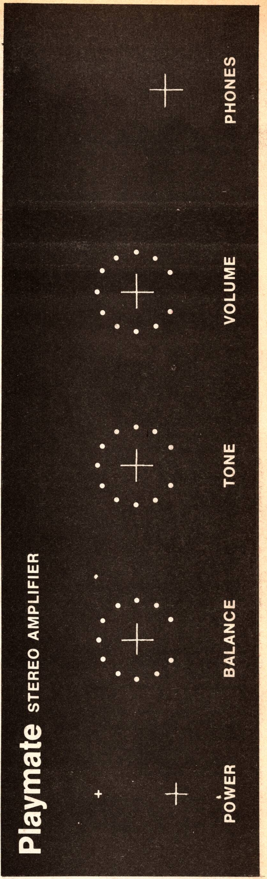
BD140 (Q7) in each channel. The multimeter is then used to measure the voltage across this resistor. If this method is to be used, the two resistors should be installed before the PCB is mounted in the chassis.

The two resistors are installed on the PCB in the positions marked "link". The resistors should be installed "end-on" so they can be shorted out after the adjustment has been made.

The optimum quiescent current, for minimum distortion, is of the order of five milliamps. While this adjustment is being carried out, the amplifiers must be loaded with a loudspeaker or dummy load.

When using the digital multimeter, adjust the trimpot in each channel for a voltage of five millivolts between the emitters of Q6 and Q7. If using the 220 ohm resistor method, adjust the trimpot for a voltage of 1V across each of the 220 ohm resistors. Then short out the resistors by twisting them and soldering.

With those adjustments made, you are ready to enjoy your Playmate amplifier. Connect a record player, tuner or cassette deck, and a pair of loudspeakers and you are in business.



Above is an actual size reproduction of the front panel artwork. Stick-on Scotchcal front panels will be available from Radio Despatch Service, 869 George St, Sydney, NSW 2000, and from other suppliers.

The Serviceman

An 18-month intermittent: Some kind of a record?

Is the pattern of service work changing? Are faults becoming more difficult as the simple component failures are being reduced? Many servicemen feel very strongly that this is so, and that both the customer and serviceman may have to get used to the idea that faults may not happen so often but, when they do, they will be much more costly to repair.

Readers of these notes might be pardoned for imagining that all I, or my colleagues, ever do is track down intermittent faults. That's not really true, of course, because if it was we would rapidly go broke. What really happens is that I choose to relate these cases in preference to most others, since I consider that they constitute the ultimate challenge, both technically and diplomatically.

Nevertheless, some of my colleagues are convinced that we are getting more of this kind of fault and less of the routine ones which pay the bills. As one of them put it, "Now that they've done away with valves, paper capacitors, and moulded mud resistors, there are no simple faults left to happen. When something does go wrong, it's bound to be a hard one!"

While something of an exaggeration, there is an element of truth in it. The proportion of hard faults to simple faults is changing, and for the reasons he states. And carrying this theme to its logical conclusion, we might expect that as components are improved still further, faults will become even fewer and even harder.

What a horrible thought!

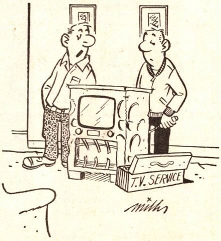
All of which is simply by way of introducing another intermittent.

This particular story concerns a "Princess" 14CTI 36cm colour set. The set is about three years old now, but the trouble first appeared when it was only about 18 months old — which means that the customer had been enduring the fault for nearly 18 months before I finally tracked it down. This must be something of a record in itself.

According to the owner, it first showed as an occasional picture failure at switch-on; no picture, no raster, "no nothing" — just a black screen. Sometimes it would come good after about 10 minutes, sometimes it would take up to half an hour. There were no other symptoms, no smoke or other signs of distress, and the sound was normal.

At first it was relatively rare, and the owner was not too disturbed by it. But it became progressively worse and, about 12 months ago, he first brought it to me. And, having listened to his story and asked a few questions, I suggested he leave it with me for as long as was necessary. Fortunately it was a second set, used mainly in the children's rumpus room, so he was not unduly worried when I told him it might take some time.

Another fortunate aspect of the situation was that the owner was a customer of long standing and one with whom I was on quite friendly terms. Had it been otherwise I doubt whether either of us would have had the patience to see the exercise through.



"I've had to kick it every now and then!" ("Radio-Electronics").

As is my custom, I set it up on a corner of the bench where I could let it run, under observation, while I attended to more routine jobs. I removed the back so that I would have ready access to the interior when it failed, with the least possible disturbance to the set itself.

Then it was simply a matter of switching on and waiting. Or so I thought. I was not really surprised when it ran faultlessly for the first couple of days; any old hand will tell you that this is par for the course. But when it kept on going, day after day, with not so much as a flicker, I couldn't ignore the situation. Eventually I had to call the customer and explain what was happening.

In particular, I felt the need to question him again, in case the fault was peculiar to his installation — though I couldn't imagine what kind of a situation could cause such behaviour. Nor did further questioning help. In the end I suggested that he take it back, take careful note of any pattern involving temperature, time of day, etc, and bring it back when he had found something — or couldn't stand it any longer.

A few weeks went by and then he was back in the shop. He hadn't been able to establish any pattern, but he had reached the stage where he couldn't stand it any longer. It was now so unreliable as to be virtually useless. As far as he was concerned, I could keep the thing as long as I liked.

Well, at least I could take my time.

In fact I had already made some enquiries of a colleague, who I discovered had handled several of these sets, some with intermittents. His advice was brief and to the point: "It's those b- wire wrap joints. Solder those and you won't have any more trouble."

He was referring to a number of lead terminations on the main board; leads to the panel controls, yoke, speaker, picture tube socket, etc. Frankly, I was sceptical. I have always been led to believe that wire wrapped joints were, statistically, more reliable than soldered joints.

On the other hand, without any better idea, what did I have to lose? So I took his advice and soldered each one. Then I put the set on trial again and let it run every day for the next couple of weeks. At the end of that time, with no sign of trouble, I felt he might have something. I rang the owner and cautiously suggested that, hopefully, I might have found it. And so the set went back into the rumpus room.

In fact, it really did seem that I had fixed it. I saw the customer from time to time over the next few months and every time he reported that the set was still going strong with no sign of the trouble. It wasn't until nearly eight months later that he walked into the shop one day, with a face as long as a wet week, and said, "I'm afraid I've got some bad news."

Then, as if I hadn't already guessed, he went on to explain that the set was playing up again, exactly as before. He had brought it with him in the car and he was quite prepared to leave it with me for as long as necessary.

So once again I set it up in the workshop and prepared for a long vigil. But one thing was obvious, I had to find a way to make the set misbehave on the bench. So far I hadn't even seen the fault.

I let it run for a couple of days and then, when nothing had shown up, I had another think about it. The only difference between the home situation and that in the workshop was that I had removed the back for ready access. In as much as the fault had always shown up when the set was cold I had assumed that removing the back was not only convenient, but might even encourage the fault.

THE FAULT AT LAST!

But now, since this was obviously not working, I tried the opposite approach; covering it with a blanket to encourage a higher temperature. And it worked; after about an hour I suddenly realised that the screen was completely black. Fortunately, I was well prepared. I had studied the circuit and board layouts and had the CRO leads ready to begin tracking video signals.

The video amplifying chain consists of five transistor stages, mostly direct coupled, but capacitance coupled between the third and fourth stages. The fifth video amplifier is then directly coupled, via level controls, to the emitters of the three (red, green and blue) driver transistors for the three picture tube cathodes. The B-Y, G-Y and R-Y signals are fed to the bases of the driver transistors.

It didn't take me long to establish that everything seemed to be normal up to the base of the fourth video amplifier, but not at the collector of the same transistor. Here the video had suddenly vanished, although the sync pulses were still present. It was as if the video had been chopped off at the black level.

At this point the set came good, leav-

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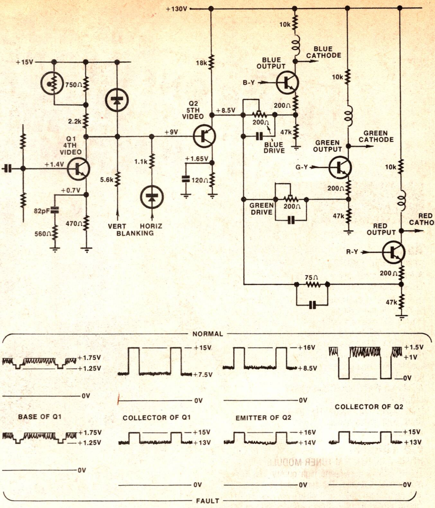

The relevant circuitry of a "Princess" 14CT1 colour TV receiver, which suffered from an intermittent picture problem virtually from new. Observation of the waveforms sketched below the circuit gave a clue to the source of the fault.

ing me with the strong impression that the fault was in the fourth video stage, and most probably in the form of an intermittent transistor. So I fitted a new transistor on spec, and then made a careful record of the normal waveforms right through to the collector of the fifth video amplifier.

Then it was another session of waiting. For a while I thought I might have fixed it, but, after a few hours, it failed again. The first thing I did was to check and record the faulty waveforms through to the fifth amplifier collector. Then I went back to the fourth stage for a more detailed search.

I went over it component by component. I froze them, heated them, and bashed them, all to no avail. I changed both diodes, plus the 82pF capacitor in the emitter circuit. Again, I drew a blank, which was all the more frustrating by reason of the time I had to wait after each change before I knew the result.

It was the waveforms I had recorded which finally gave me the clue I needed. The first thing that struck me was that, under the fault condition, the pattern at the collector of the fourth amplifier, the emitter of the fifth amplifier, and the collector of the fifth amplifier, were virtually identical.

The second, and even more important, point was that the fault condition wave form at the fifth amplifier collector, compared with the same pattern when it was working correctly, was inverted. Suddenly I had the horrible feeling that I had been backing the wrong horse; that the fault was most likely in the fifth amplifier rather than the fourth — the waveform at the fourth collector being simply a reflection of what was happening in the next stage.

The voltage levels at the fifth amplifier collector were also significant. Normally there is not much signal level here (only about 1.5V), since the stage is really an inverted emitter follower, the wanted signal being developed across the 18k emitter resistor. The collector resistor is quite small (120 ohms) and appears to perform only a secondary function, probably limiting the dissipation in the transistor.

But under the fault conditions, as well as being inverted and clipped, it was running up to 15V. Suddenly the penny dropped; it was almost certain that the collector was not going to ground as was intended, either because the 120 ohm resistor was going open circuit, or because the ground connection itself was faulty.

Thus alerted, I prepared to make the appropriate measurements the next time the fault appeared. When it did I switched off and measured from collector to chassis; feeling very gratified when it showed open circuit. It was the same story from the other end of the resistor, which led me to the copper pattern on the board.

This board, called the "Video Out Module" accommodates the three driver transistors and the fifth video amplifier, and has a moderately complex copper pattern. It is also a double-sided board and when I commenced to trace out the ground connection I realised that this not only meandered all over the board, but also transferred from one side of the board to the other.

And that was where I found the trouble. The transfer from one side of the board to the other was by means of a short length of tinned copper wire, soldered to the copper on each side.

Closer inspection, with a glass, revealed the all-too-common story. The solder, instead of flowing up the side of the wire, had formed a crater, with the wire sitting in a hole in the centre. In fact, I found that I could actually move the wire in the hole and make or break the circuit at will.

As always in such cases the cure was an anti-climax; it took only a few moments to scrape the wire with the point of a knife, then apply solder and a hot iron.

But what a nasty one. It is no exaggeration to say that a fault like this — simple enough in itself, but incredibly hard to track down — can put an expensive colour set on the tip. Because the cost of finding such faults at today's labour charges, can rapidly run into hundreds of dollars, without any indication as to when it will stop.

It wasn't quite that bad in this case, but only because the owner was able to co-operate by not putting any time limit on the job, thus enabling me to use what otherwise might have been dead time.

And the incident certainly highlights the whole problem of poor quality soldered joints. One colleague estimates that more than a quarter of the jobs he handles involve faulty soldered joints, with a significant percentage in the difficult intermittent category.

What is the answer? I wish I knew, I could probably make a fortune. All I do know is that the industry in general needs to find some way to improve the reliability in what has always been a very tricky area. The method is up to them.

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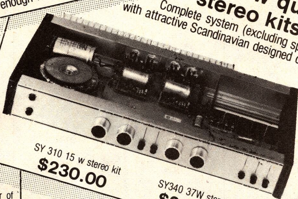

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D.C. VOLTAGE
Full Scale Value 0.1/1/2.5/10/50/250/1000V.
Accuracy ± 3% of rated value.
Internal Resistance 100.000Ω/V.
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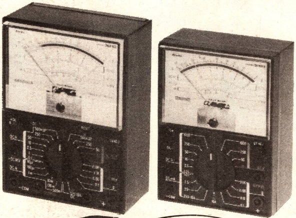
Accuracy ± 3% of rated value.
Voltage Drop 100 mV. 250 mV.
A.C. VOLTAGE
Full Scale Value 10/50/250/500/1000V.
Accuracy ± 3% of rated value.
Internal Resistance 10.000Ω/V.
A.C. AMPERAGE
Full Scale Value 10A.
Accuracy ± 4% of rated value.
RESISTANCE (OHMS)
Full Scale Value 2k/200k/2m/20mΩ (Rc 20Ω)
Accuracy ± 3% of scale length.
LOW FREQUENCY OUTPUT (DECIBELS)
20 · 36 dB.



3003 A high sensitivity meter with fuse protection, taut band movement and mirror scale. A.C. current measurement up to 10A, and output terminal for dB readings.

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Accuracy ± 3% of rated value.
Internal Resistance 30.000Ω/V
D.C. AMPERAGE
Full Scale Value 50μA/2.5/25/250mA/10A
Accuracy ± 3% of rated value.
A.C. VOLTAGE
Full Scale Value 10/50/250/1000V.
Accuracy ± 3% of rated value.
Internal Resistance 13.500Ω/V
A.C. AMPERAGE
Full Scale Value 10A.
Accuracy ± 4% of rated value.
RESISTANCE (OHMS)
Full Scale Value 5k/50k/500k/5mΩ (Rc50Ω)
Accuracy ± 3% of scale length.
LOW FREQUENCY OUTPUT (DECIBELS)
Full Scale Value 20 · 36 dB.
Accuracy ± 4% of rated value.

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A.C. VOLTAGE
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3101 Dustproof case, circuit protection fuse and convenient meter lock. Incorporates the advanced, shock-resisting core magnet taut band movement.

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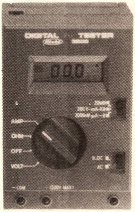
Accuracy ±3% of rated value.
A.C. VOLTAGE
150/300/600 V
Accuracy ±3% of rated value.
RESISTANCE (OHMS)
0-1 kΩ (Centre 30Ω)
Accuracy ±3% of scale length.



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D.C. VOLTAGE 5 ranges. With auto facility.
200 & 2000 mV ranges: acc. ± 0.3%rdg ± 0.1%f.s. ± 1dgt.
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200 & 1000 V ranges: acc. ± 1.5%rdg ± 0.1%f.s. ± 1dgt.
D.C. AMPERAGE 4 ranges. With auto facility.
200 & 2000 μA ranges: acc. ± 1.0%rdg ± 0.1%f.s. ± 1dgt.
20 & 200 mA ranges: acc. ± 1.0%rdg ± 0.1%f.s. ± 1dgt.
A.C. VOLTAGE 5 ranges. With auto facility.
2000 mV range: acc. ± 0.3%rdg ± 0.2%f.s. ± 1dgt.
20-200 Volts range: acc. ± 0.8%rdg ± 0.7%f.s. ± 1dgt.
200 Volts range: acc. ± 1.7%rdg ± 0.8%f.s. ± 1dgt.
1000 Volts range: acc. ± 1.7%rdg ± 0.3%f.s. ± 1dgt.
A.C. AMPERAGE 4 ranges. With auto facility.
200 μA acc. ± 1.3%rdg ± 1.0%f.s. ± 1dgt.
2000 μA acc. ± 1.3%rdg ± 0.2%f.s. ± 1dgt.
20 & 200 mA ranges: acc. ± 1.3%rdg ± 0.7%f.s. ± 1dgt.
RESISTANCE (OHMS) 6 ranges. With auto facility.
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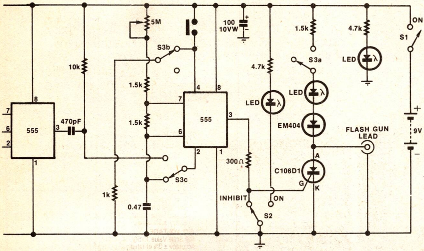
CIRCUIT & DESIGN IDEAS

Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Contributions to this section are always welcome, and will be paid for if used.

Conducted by Ian Pogson

Flash strobe addition to Sound Triggered Photo Flash



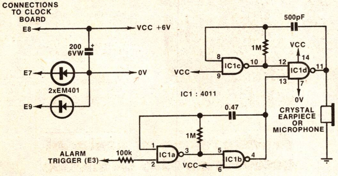
I had been considering making a device for strobing my computer-flash and on reading your article on the Sound Triggered Photo Flash in September 1979, I realised the possibility of incorporating such a feature into that unit. Some easy changes enable the Sound Triggered Photo Flash to be used as originally intended or as a photo flash strobe unit. The modifications will only be of use with a computer-flash and the number of flashes is determined by the flash unit used.

The flash strobe feature may be incorporated simply by changing one capacitor and adding four resistors, one potentiometer and two switches, one 3-pole 2-way and one press-on. The number of flashes depends on the flash unit being used and can be as many as 10 — using an Olympus 310 flash. The time interval between flashes can be as long as 1.6 seconds using the values shown and is controlled by the 5M potentiometer.

The flash will be strobed by the 555 which has been switched to an astable mode as long as the press switch is closed, or until the flash unit has discharged. When the 555 is switched back to its monostable mode the Sound Triggered Photo Flash will behave normally.

(By Mr B. Jones, 21 McMaster Street, Scullin, ACT 2614.)

Novel alarm for digital clock uses two CMOS oscillators



Having recently built a digital clock using the NS MA1002B module, I decided to add an alarm facility. The following alarm circuit which I developed may be of interest to other readers. The alarm tone is more subtle than conventional alarms which in the past have had the effect of tempting me to throw the clock out the window! Despite the more elaborate alarm tone, the cost is a fraction of a commercial buzzer, Sonalert, etc.

The circuit consists of two CMOS oscillators, one oscillating at approximately 5kHz which is gated on and off by the other at approximately 0.5Hz. The gated output of the 5kHz oscillator drives a ceramic transducer which may be either a crystal microphone or earpiece, depending on what the constructor has available. The alarm is triggered via a 100k resistor by terminal E3 on the clock board. If the constructor chooses, he may alter either the oscillator frequencies by changing the values of the 500pF and 0.47uF capacitors.

And there it is, a 4011, three resistors and two capacitors for what I believe to be a much more pleasant alarm to awake to in the morning.

(By Mr G. A. Wills, 12 Avondale Street, Clarence Park, SA 5034.)

On screen clock with 2650

Here is a program which I wrote to give an on screen digital clock display, using the 2650 mini computer. The clock works with either the EME 1 or the VDUs in EA in February, 1978. It will not operate on any VDU which gives an automatic line feed on receipt of a

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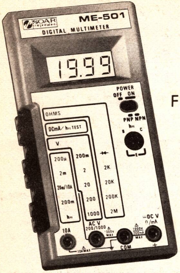

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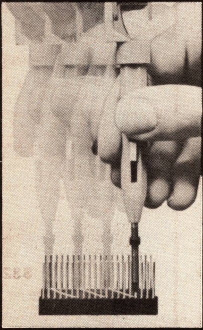

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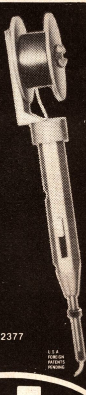

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carriage return.

Afer loading the program the clock is set by entering —

(1) current minutes in register 1,
(2) current minutes X10 in register 2,
(3) current hours in register 3,
(4) current hours X10 in memory address 0573.

Note: The numbers are entered in hex.

To regulate the clock vary the numbers at the following locations —

051F — very fine adjustment,
0521 — fine adjustment,
0523 — coarse adjustment.

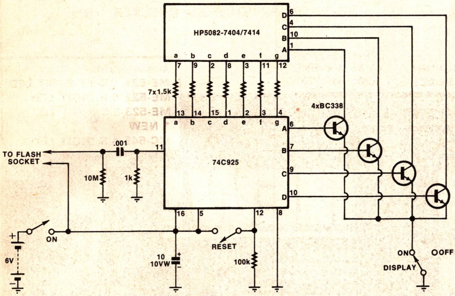
To start clock — G500 clear carriage return.

```
0500    04 0D 3F 02 B4 00 05 73 3F 02 B4 03 3F 02 B4 04
0510    3A 3F 02 B4 02 3F 02 B4 01 3F 02 B4 77 31 04 65
0520    05 65 06 65 F8 7E F9 7C FA 7A 75 30 85 01 E5 39
0530    19 03 1F 05 00 05 30 86 01 E6 35 19 03 1F 05 00
0540    87 01 06 30 E7 32 19 03 1F 05 00 0C 05 73 E4 30
0550    18 02 1B 11 E7 39 19 03 1F 05 00 04 31 CC 05 73
0560    07 30 1F 05 00 04 30 CC 05 73 07 31 06 30 05 30
0570    1F 05 00
```

Note: The clock is most effective with the cursor turned off.

(By Mr R. Reid, 12 Gemini Close, East Doncaster, Victoria 3109.)

Counter records number of camera shutter openings



Home movie enthusiasts may find this counter circuit to be a useful addition to their equipment. It plugs directly into the flash gun socket where this facility is provided on the camera. It gives a direct digital readout of the number of times the shutter opens.

The frame counter is invaluable when doing single frame time lapse and general trick photography. It can be used to time the length of scenes accurately. The HP display is very well suited to this application although it is a little expensive. The display On/Off switch saves power during long filming sessions. For the lead, I purchased a flash gun extension cable and cut off the end not needed.

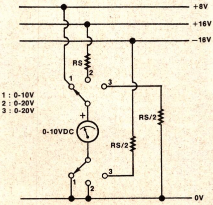
(By Mr T. Dalziell, 2 Crews Place, Wanniassa, ACT 2903.)

Make before break meter switching

Most readily available multiway rotary switches have moving contacts which connect adjacent poles as they are switched. With positive and negative supplies to be metered by a switched panel voltmeter, the results can be interesting (and brief) if some precautions are not taken.

The use of alternate poles is one solution to the problem but is wasteful and often impracticable. Using a meter requiring series resistors suggests a simple solution. Arrange the series resistors so that no damage can be done by the moving contact as shown in the circuit.

(By Mr R. V. Taylor, 7 Robin Street, Salisbury East, SA 5109.)



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This kit is absolutely complete, right down to the last nut and bolt.
(As per "Electronics Australia" Dec '79.)

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Build our reaction timer

And find out just how safe a driver you are

Here is a simple and easy to make Reaction Timer. When the red light comes on, you go for the stop button as fast as you can. The time you take is registered on the meter. Normally, your time should be less than 250 milliseconds for the pushbutton or less than 400 milliseconds for a pedal switch. How fast are you?

by GERALD COHN

When you are driving, your reaction time in an emergency can make the difference between rapid evasive action and possible fatalities. It is well known that reaction time is affected by the driver's physical condition and his psychological outlook at the time. In some cases, the driver does not register the emergency at all and drives straight into a disaster.

Some people stoutly maintain that alcohol does not adversely affect their reaction time and may even improve it. Limited tests that the author has witnessed would indeed seem to indicate that a limited amount of alcohol does not affect physical reaction time to any extent. What is affected is judgement. But that is another story.

Eventually, reaction time testing may become part of the general driver licensing procedure. Even licence renewals may be conditional upon passing a reaction test and sight test. Who knows? In the meantime, we have produced a unit to measure reaction times up to one second. If your reaction time is longer than that you are disaster material anyway!

The unit presented here will enable a number of interesting reaction tests to be made. To perform the tests, two people are required. One acts as a starter and presses a button to light up an indicator on the tester. The other person is the one being tested, and must hit their button to turn off the light. The reaction time can then be read from the meter. The starter then has a reset button to zero the meter before the test is repeated.

An approach to measuring a small time interval of less than one second can take two general directions. First, logic circuitry can be used and the result displayed in digital form. All that would be required is a 100Hz square wave oscillator driving a couple of decade counters plus the associated decoders and drivers for the digital display. The test would be merely starting and stopping the clock. The readout would be in the form of two digits which would be multiplied by ten to give the result in milliseconds. For example, a readout of 34 would represent 340 milliseconds.

An alternative and simpler approach is to use an analog circuit. This produces a steadily rising voltage which is stored and held at the end of a given time interval which represents the reaction time.

But how do you produce a steadily rising DC voltage, ie, a voltage increasing at a constant rate for a maximum interval of one second? All that is required is to charge a capacitor at a constant current. The resulting voltage across the capacitor will rise at a constant rate.

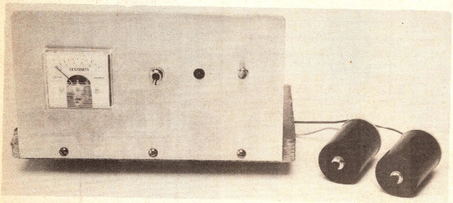
This can be shown by derivation from the fundamental relationship:

$Q = CV$

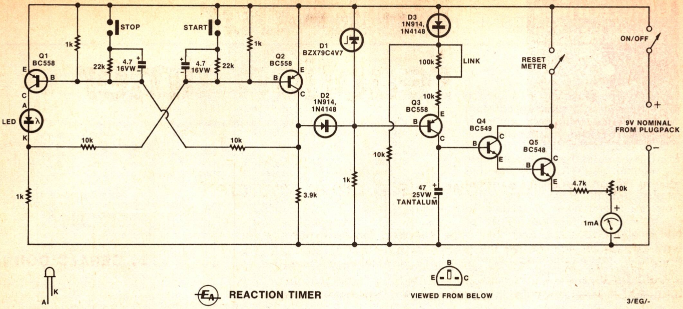
Where V represents voltage, Q represents charge in coulombs and C represents capacitance in Farads.

If we rewrite the above equation as $V = Q/C$ and then divide both sides by time in seconds, we get : rate of voltage change in volts per second is equal to the number of coulombs per second divided by the capacitance. But 1 ampere is equal to 1 coulomb per second, ie, current is the rate of charge flow. So dividing the capacitor charging current by the capacitance gives us the rate of voltage change. So the way to get a constant rate of voltage increase is to charge the capacitor with a constant current.

We can set the rate of voltage increase by selecting the value of constant current and the size of the capacitor. The capacitor must have very low leakage relative to the value of the charging current. The capacitor that we chose was a 47uF tantalum electrolytic. Aluminium electrolytics must not be used as their leakage is too high for this application. If we select a rate of voltage increase of 7 volts per second, the constant charging current required is 0.33mA.



Construction is not at all critical. We mounted the circuit board on a piece of timber with an aluminium front panel.



The circuit diagram of the timer. The flipflop (Q1, Q2) controls constant current source Q3, which provides the charging current for the 47uF capacitor.

Refer now to the circuit diagram (Fig 2). The constant charging current to the capacitor is provided by Q3 and its associated components. The basic circuit of a constant current source using one transistor is shown in Fig 1. A reference voltage provided by a zener diode is applied to the base of the transistor and the emitter resistor is selected to set the collector current. The voltage across the emitter resistor becomes the reference voltage minus the base-emitter voltage of the transistor.

In the basic circuit we have shown a zener diode which provides a reference voltage of 4.7V. This would result in a voltage across the emitter resistor of 4.0V (allowing for a base-emitter voltage of 0.7V). Any tendency for the collector current to increase would increase the emitter voltage by the same amount, which would bias the transistor off which would drop the current back to where it should be, and so on. The reverse process applies if the collector current tends to reduce.

Later on in the article we will explain the component differences between Fig. 1 and the current source Q3 in the complete diagram.

Having described how to obtain a voltage which increases linearly with time using a constant current source to charge a capacitor, we can now discuss how to start and stop the current source. We do this with an RS flipflop consisting of Q1 and Q2.

The flipflop has uneven collector loads. Q1 has a 1k resistor in series with a light emitting diode while Q2 has a 3.9k load. This means that when power is first applied to the circuit, Q2 always turns on while Q1 is held off. Q2 effectively shorts out the voltage reference zener diode D1 via D2 which turns off the current source Q3. Just to make sure that Q3 is turned hard off, diode D3 is connected in series with the emitter. The diode voltage is held constant by bias current from the 10k resistor to the 0V line.

So the situation at switch on is that Q2 is on which holds Q3 off, and so the voltage across the 47uF capacitor remains at zero. To start charging the capacitor, the START button is pressed which momentarily removes the base voltage of Q2. This turns Q2 off and Q3 on allowing the capacitor to charge.

At the same time as Q2 goes off, Q1 comes on and illuminates the light-emitting diode. The person being tested must then hurriedly press the STOP button which reverts the flipflop to its original condition and turns Q3 off. The voltage which then appears across the capacitor represents the elapsed time. All that remains is to measure this voltage while making sure that the capacitor's charge is not bled away so fast as to make the meter pointer drop rapidly. In other words, we have to measure the capacitor voltage but make sure that the current drawn off by the measuring circuit is as low as possible.

Our method of monitoring the capacitor voltage is to use a Darlington transistor pair to drive a 1mA meter via appropriate resistors. With the high beta of the composite transistor the input current from the capacitor is very low — less than 1 microamp.

The Darlington transistor pair, Q4 and Q5 actually constitute a simple "sample and hold" circuit.

Several features of the circuit remain to be explained. First, the RESET button. This resets the meter to zero after a test so that it can be repeated. Notice that the capacitor is not discharged directly by shorting out. Rather, we remove the positive supply voltage from the Darlington, so that the capacitor discharges via the two base-emitter junctions and the meter circuit.

This effectively reduces the capacitor voltage to slightly less than the forward-bias base voltage of the Darlington pair, ie, slightly less than 1.2V. So instead of rising from zero at the start of a test, the capacitor voltage rises from approximately 1.2V. This means that as soon as the capacitor voltage begins to rise during a test, the meter pointer rises accordingly.

A simple, easy-to-reproduce calibration procedure presented a major problem in development of the project. No matter how ingenious or complex a circuit such as this might be, it is useless if it cannot be accurately calibrated by the would-be constructor who has a minimum of test instruments at his disposal. We believe we have solved this in a neat fashion.

The calibration is performed by alter-

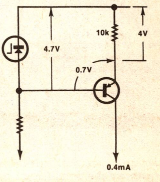


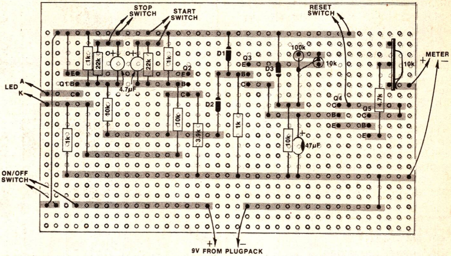
Fig 1. Basic constant current source.

ing the setting of the current source so that it delivers a smaller constant current. This is done by temporarily removing the wire link shorting the 100k resistor in the emitter circuit of Q3. This increases the total resistance in the emitter of Q3 to 110k and thus reduces the capacitor charging current to one-eleventh of the normal value. Now, the meter takes 11 seconds to reach full-scale deflection instead of one second.

So to calibrate the reaction timer, proceed as follows. Remove the wire link to insert the 100k resistor into circuit. Press the START button, wait a few seconds and press the STOP button. Now press the RESET button to zero the meter. Now press the START button, wait exactly 11 seconds and press the STOP button. Now set the 10k preset potentiometer so that the meter reads full scale. This will have to be repeated a few times because the meter reading drops slowly.

Having set the 10k preset potentiometer so that the meter takes exactly 11 seconds to rise from zero to full scale, the wire link can be replaced to short out the 100k resistor and the unit is ready to perform testing. Ideally, the 10k and 100k resistors should be 1pc units, but in practice 5pc units will be close enough.

We specify an LED in the circuit because it has almost instantaneous response time, ie, light is emitted as soon as voltage is applied. The use of an incandescent lamp in this role would inevitably cause errors because of the thermal lag of the filament.



The overlay diagram showing the cuts in the copper tracks and the placement of the components. Note the orientation of the transistors, diodes and capacitors.

Notice that the 10k resistor in the base voltage divider of Q2 is fed from the junction of the LED and the 1k resistor, and not from the collector of Q1. This is to avoid the small current flowing in the 10k resistor from partially lighting the LED.

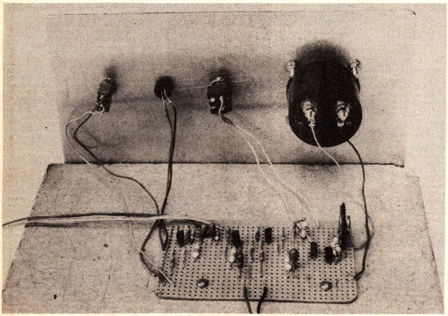
Construction of the reaction timer is not critical as far as layout is concerned. It can be built cheaply onto a piece of timber or "dressed" up to look the part of a piece of test equipment. Our approach to the construction is shown in the photographs, but this is only a suggestion.

All the circuit components are mounted on a small section of Veroboard, 60 x 95mm. We used Veroboard with 2.5mm conductor spacing which is the most readily available type.

Take care to observe the orientation of the transistors and the polarities of the diodes and the elecrolytic capacitors. These are shown in the wiring diagram.

The two resistors, 10k and 100k, associated with the constant current source, Q3, are wired "end on" and a loop of hookup wire is soldered to their ends to short out the 100k resistor. The details are shown in the wiring diagram. The idea is just to "tack" the wire with your soldering iron so that it is easily removable for the calibration procedure.

The LED, toggle switches and meter are mounted onto a piece of aluminium sheet fastened at right angles to a piece of timber. The Veroboard is also mounted on the piece of timber. The START and STOP



A rear view of the completed timer showing the wiring etc. The link across the 100k resistor can be seen just to the left of the pot.

We estimate that the current cost of parts for this project is approximately

$20

This includes sales tax but does not include the cost of the DC plugpack.

buttons were mounted in plastic film containers (pill cases would also be suitable) for easy use.

We used a 1mA meter movement and changed the units that are read from the meter to seconds instead of mA. This was done by erasing the letters "mA" and then replacing them with "SECONDS" using rub on lettering.

The STOP switch could be mounted in a floor jig with both a brake and an accelerator pedal to simulate the braking procedure, ie lifting the foot from the accelerator pedal and onto the brake pedal to halt the car. Here the STOP switch will require protection from mechanical abuse.

The unit is powered from readily available plugpack type power supplies, delivering a nominal 9V at 300mA. The voltage will normally be more than 9V at the current drawn by the circuit, and will probably be between 10 and 11 volts. Actually the circuit will function with supply voltages between 9 and 18 volts.

Well, there you have it, a device that will tell you whether or not you stand to qualify for the "Traffic Menace Of The Year Award". Go to it then. How fast is your reaction time?

Parts List

1 1mA meter movement
2 miniature SPDT toggle switches
2 miniature N/O contact pushbuttons
1 9 volt plugpack/battery eliminator (not included in price estimate)
1 piece Veroboard 60 x 95mm

SEMICONDUCTORS
3 BC558 PNP transistors
1 BC549 NPN transistor
1 BC548 NPN transistor
2 1N914 or 1N4148 diodes
1 BZX79C4V7 zener diode
1 red LED

RESISTORS (¼ or ½W, 5% tolerance)
4 x 1k, 1 x 3.9k, 1 x 4.7k, 4 x 10k, 2 x 22k, 1 x 100k
1 x 10k trimpot

CAPACITORS
2 x 4.7uF/16VW electrolytic
1 x 47uF/25VW tantalum

MISCELLANEOUS
Timber, aluminium sheet, solder, hookup wire, screws etc.

Note: Components with higher ratings may generally be used providing they are physically compatible.

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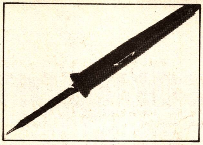

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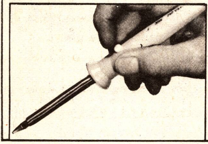

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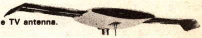

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PRACTICAL ELECTRONICS

Passive components: resistors and pots

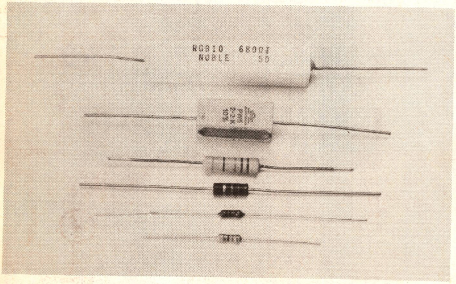
Building an electronic project involves wiring together a selected group of components — or electronic building blocks — according to a set plan. One of the most important electronic building blocks is the resistor, a simple device used to establish voltage and current levels throughout a circuit.

by GREG SWAIN

Resistors are among the most common components used in electronics. They come in a variety of shapes and sizes, but the types you will work with most often are small cylindrical devices equipped with two tinned copper leads.

As the term implies, the basic role of a resistor is to resist, or impede, the flow of current through an electrical circuit. The degree to which it does this depends upon its resistance value — the higher the value, the lower the current through the circuit concerned.

The basic unit of electrical resistance is the "ohm", often represented by the Greek letter Omega (Ω). A given resistor is thus said to have an electrical resistance (or value) of so many ohms. Practical resistor values range from a fraction of an ohm up to about 10 million ohms.



An array of typical resistors, shown slightly smaller than actual size. They range from a 10W wire-wound type at top to ¼W carbon film types at bottom.

Types of resistors

At the heart of all resistors is a central resistance element, which can be made from several different substances. These substances include carbon, a thick film of metal or metal oxide, or a wire made of suitable alloy. The element is usually wrapped inside a protective insulating shell, often vitreous enamel or a moulded epoxy material.

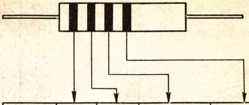
Carbon (or composition) resistors are made of a small rod moulded from a mix of finely divided carbon particles and a non-conducting binder. Different resistance values are obtained by varying the element's composition, length, and diameter. Carbon resistors are seldom used these days, however, as they tend to change value due to heat, moisture and ageing.

Wire-wound resistors consist of a length of resistance wire wound spirally on a cylindrical ceramic core. The actual resistance value depends on the nature and gauge of the wire used, and on the length of wire wound around the former. In practice, wire-wound construction lends itself best to heavy duty resistors in the lower range of values — say, from a fraction of an ohm to a few thousand ohms.

Carbon film resistors are made by depositing a layer of carbon-based material on the surface of a glass or ceramic rod. The resistance is adjusted to the required value by cutting a spiral path (or helix) into the carbon film, thus increasing its effective path length. The formulation, thickness and length of the carbon film also has some bearing on the final resistance value.

Metal glaze resistors are similar in concept to carbon film types, but use a metal or metal oxide material as the conductor. As before, the resistance value is adjusted by machining a spiral into the film.

Resistor identification — the colour code



The resistor colour code, the first two bands indicate the significant figures, the third band the multiplier, and the fourth band the tolerance.

COLOUR	TENS	UNITS	MULTIPLIER	TOLERANCE
BLACK	0	0	1	20% (M)
BROWN	1	1	10	1% (F)
RED	2	2	100	2% (G)
ORANGE	3	3	1000	—
YELLOW	4	4	10000	—
GREEN	5	5	100000	—
BLUE	6	6	1000000	—
VIOLET	7	7	—	—
GREY	8	8	—	—
WHITE	9	9	—	—
GOLD	—	—	0.1	5% (J)
SILVER	—	—	0.01	10% (K)

EXAMPLES

- *68 ohms, 5%: blue, grey, black, gold*
- *1k, 5%: brown, black, red, gold*
- *560k, 5%: green, blue, yellow, gold*
- *220 ohms, 5%: red, red, brown, gold*
- *47k, 2%: yellow, violet, orange, red*
- *2.2M, 5%: red, red, green, gold*

The resistors most often used these days are the carbon film and metal glaze types. It usually doesn't matter which type you use when building a project, and both types may be freely intermixed in the one circuit. Wirewound resistors are used far less frequently, and then only when specified by the circuit designer.

Resistance value

Every resistor, regardless of type, has three important parameters: resistance value, tolerance and power rating.

Practical resistor values, as used in most circuits, are usually based on the series 1.0, 1.2, 1.5, 1.8, 2.2, 2.7, 3.3, 3.9, 4.7, 5.6, 6.8, 8.2, 10, 12, 15 and so on up through the decades. This so-called range of "preferred" values is designed to meet the needs of the circuit designer with the minimum number of different values.

Resistance values up to 999 ohms are generally expressed directly in ohms, but between 1000 and 999,000 ohms they are expressed in kilohms, and above 1,000,000 ohms in megohms. These latter two terms are generally abbreviated by the letters "k" and "M".

What do the terms "kilohms" and "megohms" mean? It's quite simple:
1 kilohm (1k) equals 1000 ohms; and
1 megohm (1M) equals 1,000,000 ohms.

Thus 2.2k means the same things as 2200 ohms, 3.3k means 3300 ohms, and 6.8k means 6800 ohms. Similarly, 1.2M means 1,200,000 ohms, 2.7M means 2,700,000 ohms, and 8.2M means 8,200,000 ohms.

Quite often, you will find that the k and M symbols are used in place of the decimal point. A few examples will serve to illustrate this last point: 2k2 instead of 2.2k, 6k8 instead of 6.8k, 1M2 instead of 1.2M and 8M2 instead of 8.2M.

Resistor tolerance

Because it is impossible to mass produce electronic components to absolutely exact values, resistors and other parts are graded according to tolerance. In other words, the components are marked according to how closely their actual values match their marked values. You will usually work with resistors having 5% tolerance, although some precision circuits may require 2%, or even 1%, resistors.

Confused about the concept of tolerance? No need to be! Consider, for example, a nominal 1k 5% resistor. All this means is that the actual value of the resistor could differ from its marked value of 1k by up to ±5% — that is, its value could be anywhere between 950 and 1050 ohms.

In practice, the variation from the marked value is usually well inside the specified tolerance range. Most 5% resistors, in fact, are actually within two per cent of their rated values.

A word of warning: electronic circuits are designed to take into account component tolerances, so don't be trapped into thinking that a circuit will work better with 2% resistors when 5% types have been specified. It probably won't make any difference, and the extra money spent on the close-tolerance resistors will have been wasted.

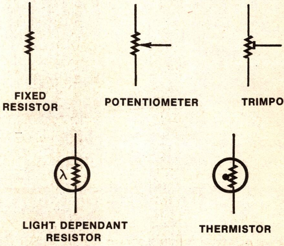
Power rating

As well as being manufactured to specified tolerances, resistors also have a specified maximum power rating. This specifies the maximum rate — in watts — at which a resistor can safely dissipate electrical energy as heat. The power rating is closely related to the physical size and design of the resistor.

Most of the resistors used in today's electronic circuits are ¼ watt (¼W) and ½ watt (½W) types, although occasionally resistors with higher power ratings are specified. Never use a resistor whose power rating is less than that specified on the circuit — eg a ¼W resistor in place of a 1W resistor. If you do, the resistor will overheat and eventually fail.

Note, however, that it is quite okay to use a resistor whose power rating exceeds that specified. The only proviso is that the size of the resistor be physically compatible with the method

Resistor circuit symbols



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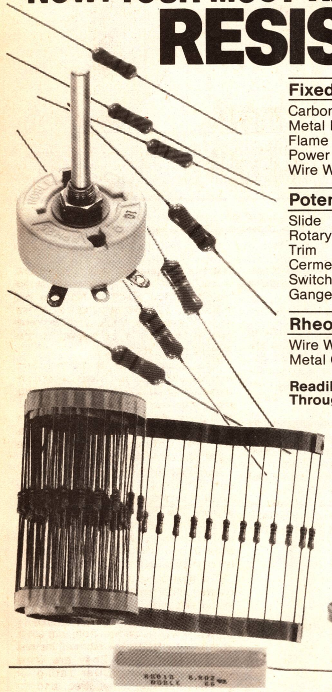

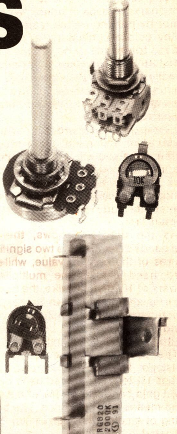

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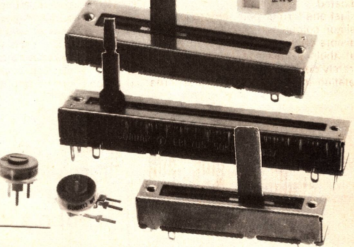

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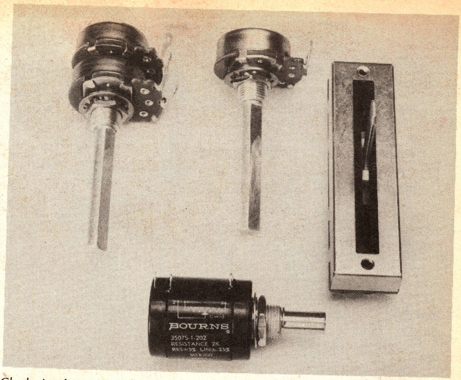


Clockwise from top left: dual ganged potentiometer, standard carbon potentiometer, slider potentiometer, and precision 10-turn wire-wound potentiometer.

of circuit construction. Using a 5W resistor in place of a ½W resistor on a printed circuit board is definitely not the way to go.

Identifying resistor value

Depending upon its type and size, a resistor can be branded with its important characteristics in one of two ways: either by printing on the resistor body, or by colour coding. As a rule, only close tolerance and high power resistors have the relevant information directly printed on their bodies. This information usually includes the resistance value, the tolerance and the power rating.

Low-power resistors, including carbon-film and metal glaze resistors — the types you will use most often — are invariably identified by a group of four parallel colour bands. These bands are positioned near one end of the resistor body to tell you which band to read first.

As the diagram shows, the first two bands designate the two significant figures of the resistor value, while the third band defines the multiplier in powers of 10 (or, if you like, the number of zeros after the first two figures). The accompanying table matches up the band colours with their corresponding digit and multiplier values.

The fourth band represents the resistor's tolerance. A brown band means 1% tolerance, a red band means 2%, a gold band means 5%, and a silver band means 10% tolerance. The power rating of a colour-coded resistor is not indicated.

Just one further point before leaving resistor colour codes: close tolerance resistors often use five colour bands so that their values may be more accurately designated. Once again, interpretation is quite easy. The first three bands indicate the significant figures, the fourth band the multiplier, and the fifth the tolerance.

Variable resistors

In addition to fixed value resistors, several types of variable resistors are also commonly used in electronic circuits. These variable resistors are called potentiometers, and allow the user to adjust some aspect of circuit operation at the twist of a knob.

The volume, bass and treble controls on your hifi amplifier are potentiometers, as are the brightness and contrast controls on your TV set.

A potentiometer is a three-terminal device of quite simple construction. The common carbon potentiometer — or "pot" — consists of a resistive track of carbon formed into a three-quarter circle and equipped with a moveable metal "wiper" arm that slides along the track's surface. Electrical contacts are brought out to two terminals at either end of the resistive track, while the third central terminal is connected to the moving wiper arm.

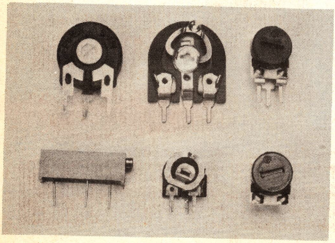
The wiper arm is connected mechanically (but not electrically) to a plastic or metal shaft. By rotating this shaft, the user can shift the wiper to make contact anywhere on the resistance element, thus altering the effective resistance between one of the outer terminals and the wiper.

Two different types of carbon potentiometers are available — the linear pot and the logarithmic pot. As you would expect, the linear pot has a linear relationship between wiper movement and resistance, while the logarithmic pot has a logarithmic relationship and is commonly used as a volume control.

The type of pot to be used will be indicated either on the circuit diagram or in the parts list.

Wire-wound pots operate in exactly the same way as carbon pots, but use a wire-wound resistance element instead of a carbon track. They are used whenever higher power rating or greater precision is required, and for very low resistance values (generally those below 1k).

In practice, wire-wound pots are seldom used by the hobbyist. Never use a standard carbon pot when a high power wire-wound type has been specified, though — its rating (around



Vertical and horizontal mounting trimpots. Trimpots are available in a range of values up to about 2M.

½W) will probably not be adequate for the job. Unless otherwise indicated, you can assume that all potentiometers shown on a circuit are standard carbon types.

Identifying the value of a pot is easy enough. It's usually stamped or printed onto the pot's outer protective metal housing along with the letter "A" or the letter "B". The letter indicates whether the pot has a linear response (A) or a logarithmic response (C). On some brands, the response may be directly indicated by the words "lin" or "log".

Trimpots

Another fairly common type of variable resistor is the preset potentiometer, or trimpot. Physically smaller than standard potentiometers, trimpots are designed for mounting on a printed circuit (PC) board and are used to make critical circuit adjustments at various stages of construction. Once set, they are not normally readjusted.

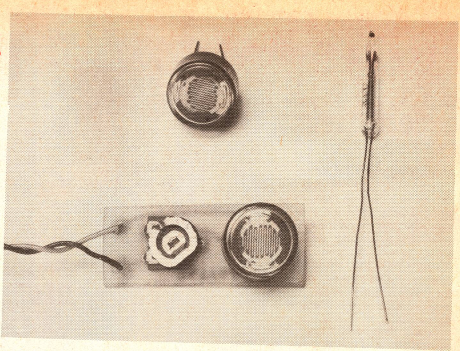
Adjustment of the wiper arm is by means of a screwdriver slot at the centre of the device. Once again, identification of resistance value is easy — it's usually printed somewhere on the trimpot body.

Many other types of potentiometers are also available, including concentric and dual ganged pots, precision multi-turn pots, multi-turn trimpots, and slider pots. Dual ganged pots are most commonly used in stereo amplifiers and consist of two potentiometers joined together and controlled by a single shaft. In this manner, two separate circuits can be controlled by twisting a single knob.

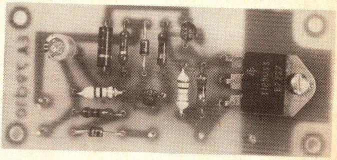
LDRs and thermistors

Light and heat have little or no effect on the nominal resistance of ordinary resistors. There are, however, two classes of resistors which are specially designed to exhibit marked changes in resistance when exposed to these influences: light dependent resistors and thermistors.

Briefly, a light dependent resistor, or LDR, is a device whose resistance varies from a low value in bright light conditions to a high value, typically around 10 megohms, in darkness. It is made of a special light sensitive material (eg cadmium sulphide) which produces more conduction electrons when exposed to light. The minimum resistance obtainable depends on the particular LDR, but ranges from approximately 75 ohms to 300 ohms.



Light dependent resistor (left) and thermistor (right). Also shown is an LDR mounted on a small PC board, together with a miniature trimpot.



View showing how resistors are soldered into place on a printed circuit (PC) board. There are seven resistors on the board in all.

LDRs are often used as light sensing devices in burglar alarm systems, and in light beam detection systems placed across doorways.

The second device, the thermistor, is similar to an LDR, except that it exhibits large changes of resistance with temperature. Both negative temperature coefficient and positive temperature coefficient types are available. In the case of negative temperature coefficient devices, the resistance decreases with increasing temperature; for positive temperature coefficient devices, the resistance increases with increases in temperature.

Thermistors are commonly used to provide temperature compensation in certain critical circuits.

Working with resistors

There's probably only one way to damage a resistor and that's to try really hard. The devices are so simple that there's little that can go wrong — it doesn't even matter which way round you solder a resistor into circuit. (Note: this does not apply to pots). Here are the main points to remember:

- Avoid overheating when soldering. Excessive heat can damage the resistance element, and change the resistance value;
- Always use the correct wattage resistor. A resistor whose rating is too low will overheat and eventually fail;
- Don't strain the leads. Too much strain can detach the leads from the resistance element;
- Check the colour code carefully to make sure that you're using the right value. Use the wrong value and you could damage the resistor and other nearby components;
- Don't use too much solder when soldering pot terminals. Excess solder can creep up the terminals and damage the resistance element;
- Follow the wiring diagram carefully when wiring pots into circuit. If the two outer leads are transposed, the control will work backwards (note: this will not cause any damage to the circuit).

So much then for resistors. In the next chapter we will find out about another important building block used in electronic circuitry — the capacitor.

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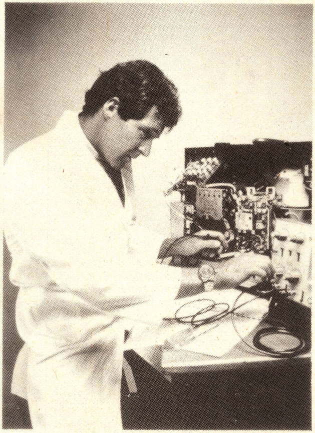

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The S-100 Bus & how to interface a 2650 to it

Most computer enthusiasts have heard about the S-100 bus system, and that a wide variety of memory boards, floppy disc controllers, video interfaces, speech synthesisers and other fancy peripheral boards are made for it. But do you know how the S-100 bus works, and how it evolved? This article describes the basic S-100 system and tells you how to provide your 2650 Mini Computer with an S-100 interface.

by JAMIESON ROWE

Back in January and February 1975, the US magazine Popular Electronics described a build-it-yourself microcomputer project called the "Altair 8800". Based on the 8080 microprocessor, which had not long been released by Intel, the Altair had been designed by MITS, Inc, a firm in Albuquerque, New Mexico. In fact the authors of the Popular Electronics articles were two of the MITS engineers responsible for the design: H. Edward Roberts and William Yates. Following publication of the articles, MITS began selling the Altair in both kit and fully assembled form.

The Altair 8800 wasn't the first microcomputer described for home construction. The US magazine Radio-Electronics had described a machine called the "Mark-8" in their July 1974 issue, while here at Electronics Australia we had begun to describe our EDUC-8 design in the following month. But in the US in particular, the Altair became very popular — so popular, in fact, that it is generally regarded as having launched the US hobby computer industry.

Although the original Altair design used permanently wired multi-conductor ribbon cable to interconnect the various printed circuit boards (PCBs), MITS soon changed over to a motherboard and plug-in PCB system to permit more convenient expansion. The plug-in PCB cards were double sided and mated with 100-way edge connector sockets having two rows of 50 contacts spaced on 0.125in (3.2mm) centres.

Not all of the 100 connections provided by the sockets were actually used for the Altair's interconnection "bus" lines. In fact only about 60 were used initially, the rest being left for future expansion. Sixteen lines were used for addresses, eight lines each for data into and out of the processor, and the remaining 28 lines for control signals and power supply rails.

As the popularity of the Altair design grew, other manufacturers hopped on the bandwaggon with memory boards and a variety of peripheral interface boards, all designed to plug into the Altair's 100-way sockets and hook up to its interconnection bus. The "Altair bus" thus became a de facto interconnection standard, followed fairly closely by everyone who wanted to make plug-ins for the Altair.

Then alternative processor boards and complete computers started to appear. These were obviously designed to compete with the Altair computer, but used the same nominal interconnection bus so that they could take advantage of the variety of available plug-ins to offer the same degree of expansion flexibility.

It was not practical for competing computer manufacturers to continue calling the de facto interconnection standard the "Altair bus", so it became known as the "S-100 bus".

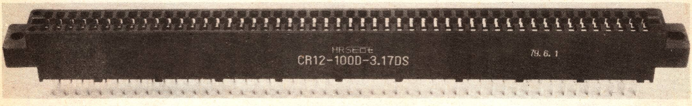
At this stage it should be noted that because the original Altair machine used an 8080 processor, many of the control signals on the Altair bus were basically 8080 control signals. This posed no problems as far as the first few competing machines were concerned, as they too used the 8080 processor. So for a while at least, the S-100 bus was basically a "pure" Altair/8080 standard.

But as time wore on, other processors started to appear, and many of these were "later generation" processors which neither required nor generated all of the control signals used by the 8080. As a result, manufacturers of these new processor boards were faced with either making the new processors "pretend" to be an 8080, or producing S-100 boards which ignored some of the control signals which had been used on the original Altair bus.

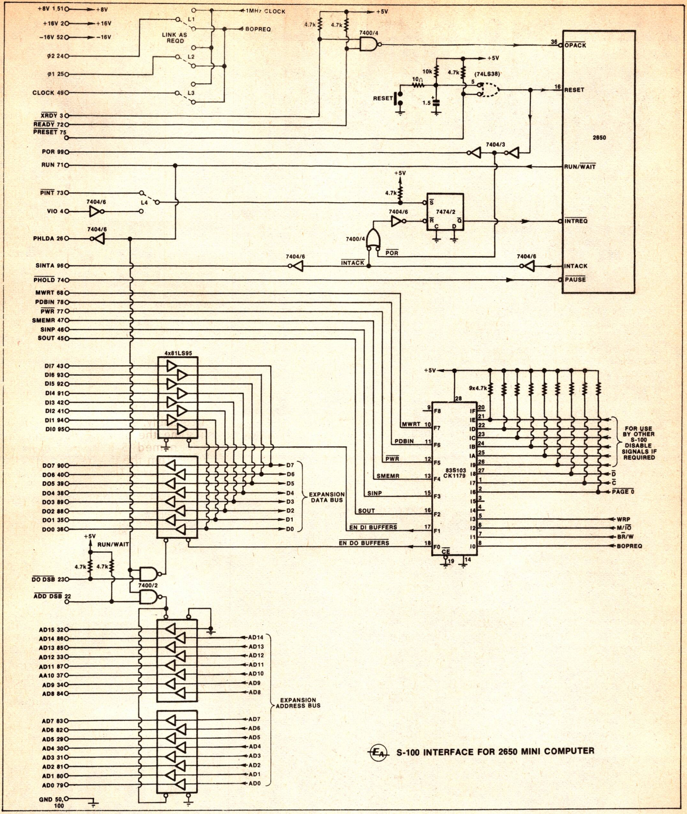
Predictably, some took one course and some the other. As a result the newly named S-100 bus began to diverge from the original "pure 8080" Altair standard. The divergence grew even more as those making memory and peripheral plug-in boards began to take advantage of some of the features offered by the newer processors and dedicated controller chips.

So what happened was that although the S-100 bus system had become an "industry standard", its effectiveness as a standard dropped significantly. Whereas it had been possible to plug virtually any board made for the Altair bus into an Altair machine and get it going almost immediately, people soon found that all boards made for the S-100 system were by no means equal. There could be all sorts of problems in trying to combine S-100 boards from different manufacturers, and some S-100 boards just couldn't be made to work together at all — either because of signal timing differences, or because some boards needed signals that the others didn't produce.

Nowadays, the S-100 bus system is still regarded in the USA as one of the



The 100-way edge connector socket used by S-100 plugins. It has two rows of 50 contacts, spaced on 3.2mm centres and numbered 1-50 on one side, 51-100 on the other (running in the same direction). Courtesy Radio Despatch Service.



The author's suggested circuit for an interface to allow S-100 boards to be used with the 2650 Mini Computer.

major buses used by the hobby and small business computer industry. But it is now only one such bus among many, even in that country; quite a few of the newer personal computers have used other bus systems for expansion purposes. And it has never been as popular in other countries as it has been in the USA, for a variety of reasons.

Why then would you want to provide your 2650 Mini Computer with an S-100 bus interface ? Simply because there are still all sorts of interesting plug-ins which are made for the nominal S-100 bus. Big static and dynamic RAM boards, PROM boards, bubble memory boards, floppy disc controllers, speech synthesisers, video boards, music generators, and all sorts of fancy I/O (input/output) interfaces. If you want to hook up your 2650 system to way-out things like these, an S-100 interface is probably the best way to do it.

Table 1 shows the S-100 bus signals that have nowadays become fairly standardised. The table shows the pin number and the usual shorthand label

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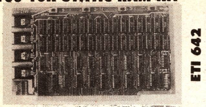
S100 16K STATIC RAM KIT



16K, 2114, Low Power 1.2 Amps Typ. for 16K, 300 or 450nS, 4K addressing, 4K write protect switches, Cromemco bank select, wait states, plated thru-holes, solder mask. See FEB. E.T.I. project for details. Assembled and tested $380.00, $5.00 P&P Reg. mail. Kit price $315.00.

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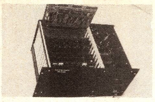

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S100 2708/2716 Programmer Kit	$175.00
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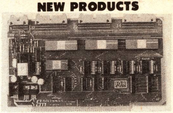

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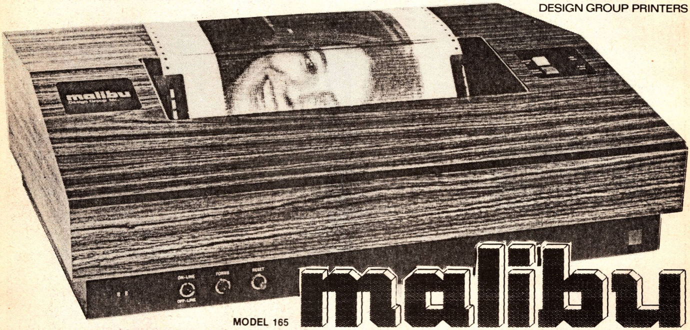

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- LSI Hydra Ballistic™ printhead, 9 wire, 12 x 9 matrix
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Controls:
- Lighted "Power On" switch
- FORMS Override allows printing to bottom of last form after the "out of paper" switch has been activated
- ADJUST UP, ADJUST DOWN provides vertical forms positioning
- LINE FEED advances the paper at the slew rate
- FORM FEED advances the paper to next top of form

Functional with optional controller card only
- ON LINE, OFF LINE
- RESET reinitializes the controller card
- SELECT De-Select with LED indicator
- TEST causes the printer to go into a self-test mode printing a rotating character pattern

Software Routines:
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- Two type fonts: high speed and letter quality, software controlled automatic speed change
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Physical:
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Optional Interfaces:
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TABLE 1: THE MAIN S-100 BUS SIGNALS

Pin	Signal	Explanation
1	+8V	Unregulated input to +5V regulators on plug-in cards.
2	+16V	Positive unregulated voltage supply.
3	XRDY	External Ready — ANDed with PRDY (pin 72) and connected to READY on the 8080. If XRDY and/or PRDY are pulled low, the CPU will enter a Wait or memory cycle extend state until both are high. XRDY is often used as a front panel control and can allow single stepping. PRDY is usually used to signal valid data from slow memory.
4	VI0	Vectored Interrupt 0 — A vectored interrupt system is used when very fast multiple interrupt response is required and is implemented with a special circuit card.
5	VI1	Vectored Interrupt 1
6	VI2	Vectored Interrupt 2
7	VI3	Vectored Interrupt 3
8	VI4	Vectored Intterupt 4
9	VI5	Vectored Interrupt 5
10	VI6	Vectored Interrupt 6
11	VI7	Vectored Interrupt 7
12	—	These pins not standardised.
13	—	
14	—	
15	—	
16	—	
17	—	
18	$\overline{\text{STAT DSB}}$	Status Disable — A low on this line puts the status line buffers SMEMR, SINP, SMI, SOUT, SHLTA, SSTACK, SWO, and SINTA into a high impedance state.
19	$\overline{\text{C/C DSB}}$	Command/Control Disable — A low on this line puts the command/control line buffers PHLDA, PSYNC, PDBIN, PINTE, $\overline{\text{PWR}}$, and PWAIT into a high impedance state.
20	UNPROT	Unprotect — A positive pulse resets the Protect flipflop on the currently addressed board so that it can accept data. (Compare with PROT, pin 70.)
21	SS	Single Step — Used by front panel. A high disables input buffer while panel drives bidirectional data bus.
22	$\overline{\text{ADD DSB}}$	Address Disable — A low on this line puts the 16 address line buffers into a high impedance state.
23	$\overline{\text{DO DSB}}$	Data Out Disable — A low on this line puts the 8 processor data output line buffers into a high impedance state.
24	ϕ2	Phase 2 clock — The master timing signal for the bus in 8080-based systems.
25	ϕ1	Phase 1 clock
26	PHLDA	Halt Acknowledge — Processor command/control output signal which goes high following a HOLD signal. It indicates that the data and address buses have gone to the high impedance state and the processor has entered the HOLD state after completion of the current machine cycle.
27	PWAIT	Wait — Command/control signal out which, when high, acknowledges that processor is in a Wait or extended memory cycle state.
28	PINTE	Interrupt Enable — Command/control signal out which indicates condition of Interrupt Enable flipflop.
29	A5	Address Bit 5
30	A4	Address Bit 4
31	A3	Address Bit 3
32	A15	Address Bit 15
33	A12	Address Bit 12
34	A9	Address Bit 9
35	DO1	Data Out Bit 1
36	DO0	Data Out Bit 0
37	A10	Address Bit 10
38	DO4	Data Out Bit 4
39	DO5	Data Out Bit 5
40	DO6	Data Out Bit 6
41	DI2	Data In Bit 2
42	DI3	Data In Bit 3
43	DI7	Data In Bit 7
44	SM1	8080 status output signal which, when high, indicates that the current bus cycle is an op code fetch.
45	SOUT	Status output signal which, when high, indicates that the address but contains the address of an output device and the data bus will contain the output data when PWR is active (low).

(Continued on next page)

for the signal concerned, together with a brief explanation of the signal's function. The information should be fairly self evident, but a few supplementary comments may help to make things clearer.

Note first that no signals are specified for pins 12-17 and pins 55-67 inclusive. This does not signify that these pins do not carry signals, or that they are ignored by S-100 boards and systems. Quite the contrary; in fact, many current S-100 systems do employ these pins to carry quite important signals. The problem is that use of the pins is not sufficiently standardised to allow each one to be given a fixed signal allocation.

For example pin 13 is used in various systems to carry interrupt request (IRQ), phase 3 shift clock (CK3), standby power (STDBY), pause status (PAUSE) or memory bank 8 select. Similarly pin 67 is used in various systems to carry signals such as phantom disable (PHANTOM), non-maskable interrupt (NMI), refresh disable (RFSHDSBL), memory disable (MDSBL), refresh (RFSH), video sample clock (SCLK) or address line 19 (A19).

So for some S-100 boards, these pins may carry signals which are essential for correct operation. But because the signals are not standardised, it is not really feasible to provide them in a generalised S-100 interface.

The next thing to note is that among the standardised signals, there is a certain amount of duplication and functional overlapping. For example XRDY-bar (pin 3) and PRDY-bar (pin 72) both perform the same function, while PINT-bar (pin 73) and VI0-VI7 (pins 4-11) overlap in their functions. These redundancies are largely the result of the ad hoc way in which the S-100 bus was developed.

It should also be noted that many of the S-100 control signals are basically those used by an 8080 microprocessor. As such these signals are often not particularly compatible with either more modern processors, or peripherals designed to go with them. It may be either difficult to derive the 8080-type signals from those actually generated, or difficult to use them once derived and fed along the bus, or both.

So, in providing an S-100 interface, you are faced with the choice of either making your processor "pretend" to be an 8080 and using the standard S-100 control signals, or ignoring these signals and using alternative control signals on some of the unstandardised bus pins.

The first approach will tend to give you somewhat greater compatibility with the wide range of available S-100 plug-ins. But it may also involve clumsy interfacing logic, and prevent you from taking full advantage of the features offered by a more modern processor. The second approach may tend to be more elegant and more powerful, but

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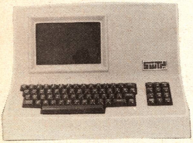
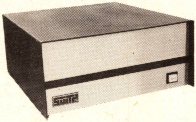
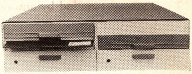


Intelligent Terminal



6809 Central Processor



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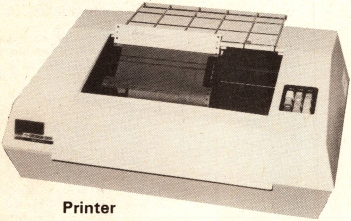

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tends to introduce hassles when you try to use certain S-100 boards. The choice is up to you.

Of course, some of the S-100 control signals are more important than others. Some signals are only needed if you plan to have a fancy front panel on your system — a feature which is not as popular nowadays as it was. Others are only used for things like a hardware-implemented single step facility, or stack management hardware external to the processor. If you don't want these facilities, or don't need them, then the signals can be ignored.

Perhaps the remaining general point that should be made about the S-100 bus is that as you can see, it uses two 8-bit data buses: one for data into the processor, and the other for data out of the processor. This is a carryover from the original Altair design, and is again a little clumsy by modern standards. In general only one of the two buses is ever in use at any instant, so it would be more elegant and efficient to have a single bidirectional bus.

But if you want to make your interface compatible with most of the S-100 plug-ins, you have to provide for the two separate data buses — clumsy though they may be. Of course you can always provide your own bidirectional bus as well, using eight of the unstandardised pins. Just make sure that the pins you use aren't needed by any of your S-100 plug-ins for special control signals.

Well then, let's get down to specifics. What's involved in providing an S-100 interface for your 2650 Mini Computer system?

Before going any further, I would like to stress that the remainder of this article consists basically of a set of suggestions, rather than the description of an interface that has been built up and tested. The circuit diagram given has not been tested, as this would have involved a considerable amount of time and effort which could not really be justified in view of the limited interest. But it has been prepared from a careful survey of S-100 literature and reference material, and I believe it to be fully practical.

Basically if you want to provide your 2650 system with an S-100 interface which provides each and every one of the various standardised control signals, it isn't easy. But on the other hand, some of the control signals turn out to be unnecessary in a 2650-based system, except in very rare circumstances.

The interface shown in the circuit diagram provides only the main control signals, but should be suitable for interfacing your 2650 system to most S-100 plug-ins.

Let's run through the circuit, starting from the bottom and working upward. First are the 16 address lines AD0-AD15, buffered by a pair of 81LS95 or similar Tri-state octal buffers. The inputs for

46	SINP	Status output signal which, when high, indicates that the address bus contains the address of an input device and the input data should be placed on the data bus when PDBIN is active.
47	SMEMR	Memory Read — Status output signal which, when high, indicates that the data bus will be used to read memory data.
48	SHLTA	Halt Acknowledge — Status output signal which, when high, acknowledges that a HALT instruction has been executed.
49	$\overline{\text{CLOCK}}$	Phase 2 clock inverted
50	GND	Signal and power ground
51	+8V	Same as pin 1
52	—16V	Negative unregulated voltage supply
53	$\overline{\text{SSW DSB}}$	Sense Switch Disable — A low disables the data input buffers so the input from the sense switches may be strobed onto the bidirectional data bus.
54	$\overline{\text{EXT CLR}}$	External Clear — A low clears I/O devices.
55	—	These pins not standardised.
56	—	
57	—	
58	—	
59	—	
60	—	
61	—	
62	—	
63	—	
64	—	
65	—	
66	—	
67	—	
68	MWRITE	Memory Write — A high indicates that the current data on the Data Out Bus is to be written into the memory location currently on the address bus.
69	$\overline{\text{PS}}$	Status of protect flipflop (low for protect).
70	PROT	Protect — A positive pulse sets the protect flipflop.
71	RUN	Run — A high indicates that the Run/Stop flipflop is set to RUN.
72	$\overline{\text{PRDY}}$	Ready — See pin 3.
73	$\overline{\text{PINT}}$	Interrupt Request — A low causes the processor to recognise an interrupt request at the end of the current instruction or while halted. If the CPU is in the Hold state or if the Interrupt Enable flipflop is reset, it will not honour the request.
74	$\overline{\text{PHOLD}}$	Hold — A low requests the processor to enter the Hold state. It allows an external device to gain control of the address and data buses as soon as the current machine cycle is completed.
75	$\overline{\text{PRESET}}$	Reset — A low causes the contents of the program counter to be cleared and the instruction register is set to 0.
76	PSYNC	Sync — The command/control signal out which, when high, identifies the beginning of an 8080 machine cycle.
77	$\overline{\text{PWR}}$	Write — The command/control signal out which, when low, signifies the presence of valid data on the Data Out bus.
78	PDBIN	Data Bus In — The command/control signal out which, when high, requests data on the DI bus from the addressed memory or I/O.
79	A0	Address Bit 0
80	A1	Address Bit 1
81	A2	Address Bit 2
82	A6	Address Bit 6
83	A7	Address Bit 7
84	A8	Address Bit 8
85	A13	Address Bit 13
86	A14	Address Bit14
87	A11	Address Bit 11
88	DO2	Data Out Bit 2
89	DO3	Data Out Bit 3
90	DO7	Data Out Bit 7
91	DI4	Data In Bit 4
92	DI5	Data In Bit 5
93	DI6	Data In Bit 6
94	DI1	Data In Bit 1
95	DI0	Data In Bit 0
96	SINTA	Interrupt Acknowledge — The status output signal which, when high, identifies the instruction fetch cycle(s) that immediately follow an accepted interrupt request presented on $\overline{\text{PINT}}$.
97	$\overline{\text{SWO}}$	Write/Output — The status output signal identifying a bus cycle which, when low, transfers data from processor to memory or I/O.
98	SSTACK	Stack — Status output signal which indicates, when high, that the address bus holds the pushdown stack address from the Stack Pointer and that a stack operation will occur on the current cycle.
99	POC	Power On Clear — Generated by PRESET or power on. Used to reset CPU and I/O devices.
100	GND	Signal and power ground

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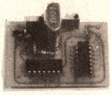
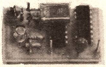


Model BSC 11



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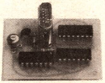

Model BSC 13/22

the buffers are taken from the address lines (already buffered) on the 2650 Mini Computer's expansion board.

Note that the S-100 bus requires 16 address lines, whereas the 2650 system only has 15 lines available (AD0-AD14). The input of the 16th buffer is therefore tied permanently to ground.

One enable input of each of the 81LS95 address buffer devices is connected to a gate. This allows the buffers to be disabled, and the S-100 address lines to be floated in a high impedance state, either in response to the ADD DSB-bar signal (pin 22) or when the processor is halted. Other S-100 boards are thus able to take control of the address lines, for things like DMA (direct memory access) data transfers.

Moving upward, we find two more 81LS95 octal buffers, the first used to buffer the S-100 data out lines DO0-DO7, and the second to buffer the S-100 data input lines DI0-DI7. As with the address buffers, the data out buffers are controlled by another gate, so they can be disabled either in response to the DO DSB-bar signal (pin 23) or when the processor is halted.

In addition, both the DO and DI buffers are controlled separately by two of the outputs of an 82S103 device. This is a programmable gate array, which Signetics and Philips are making available pre-programmed with the logic functions necessary to generate eight key S-100 control signals from the existing 2650 control signals OPREQ, R-bar/W, M/IO-bar and WRP.

As you can see, besides the two data buffer control signals the device also produces the S-100 signals SOUT (pin 45), SINP (pin 46), SMEMR (pin 47), PWR-bar (pin 77), PDBIN (pin 78) and MWRT (pin 68). So it really takes some of the hassles out of making the 2650 "pretend" to be an 8080!

The preprogrammed version of the 82S103 is coded with the suffix CK1179, and is available from your normal parts supplier on order from Philips Industries. It should cost you less than $10, including tax.

The programming chart for the 82S103/CK1179 is shown in Table 2, for the benefit of those who want to analyse the logic functions involved in producing the S-100 signals. Note that device inputs I4, I5 and IF are not used, and can be left unconnected; similarly the ninth device output F8 is not used. Note also that inputs I6 to IE inclusive are all effectively programmed to act as active-high enable inputs, so that they must all be taken to logic high level for any output to be enabled.

What this means is that these inputs may effectively be used to disable the S-100 interface, whenever the processor is dealing with the memory and I/O ports provided in the original 2650 system. This is done simply by connecting active-low enable signals from the existing 2650 system to some of the 82S103 enable inputs, as shown. The remaining enable inputs are simply tied

TABLE 2: 82S103/CK1179 PROGRAMMING CHART

INPUT VARIABLES																OUTPUT FUNCTIONS		
I0	I1	I2	I3	I4	I5	I6	I7	I8	I9	IA	IB	IC	ID	IE	IF	OUTPUT	POLARITY	NAME
H	H	—	—	—	—	H	H	H	H	H	H	H	H	H	—	F0	L	$\overline{\text{DO enable}}$
H	L	—	—	—	—	H	H	H	H	H	H	H	H	H	—	F1	L	$\overline{\text{DI enable}}$
—	H	L	—	—	—	H	H	H	H	H	H	H	H	H	—	F2	H	SOUT
—	L	L	—	—	—	H	H	H	H	H	H	H	H	H	—	F3	H	SINP
—	L	H	—	—	—	H	H	H	H	H	H	H	H	H	—	F4	H	SMEMR
H	H	—	H	—	—	H	H	H	H	H	H	H	H	H	—	F5	L	$\overline{\text{PWR}}$
H	L	—	—	—	—	H	H	H	H	H	H	H	H	H	—	F6	H	PDBIN
H	H	H	—	—	—	H	H	H	H	H	H	H	H	H	—	F7	H	MWRT
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	F8	—	—

I0 = OPREQ; I1 = $\overline{\text{R}}$/W; 12 = M/$\overline{\text{I0}}$; 13 = WRP; 16—1E = enable inputs (active high)

high via pullup resistors.

So if you have already provided your 2650 system with 7k of RAM, in addition to the 1k PIPBUG ROM, and this memory is all in page 0, you obviously won't want any S-100 boards to respond when this part of memory space is being addressed. This is achieved quite simply by connecting the PAGE 0-bar enable signal (from the 74LS138 decoder on the expansion board) to say input I6 of the 82S103, as shown.

Similarly if you have already implemented the four 2650 non-extended I/O ports, you can disable the S-100 interface whenever these are being addressed simply by connecting the C-bar and D-bar signals (again from the 74LS138 on the expansion board) to inputs I7 and I8.

Inputs I9-IE inclusive are still available, and may be used to disable the S-100 interface for any other memory blocks or I/O addresses you may have already implemented. All you need to do is derive an active-low signal from each enable signal, and connect these to the spare inputs. Since there are six available inputs (apart from those used for PAGE 0-bar, C-bar and D-bar), this should provide enough flexibility for almost any situation.

Moving further up the circuit diagram, we find the circuitry for the remaining S-100 control signals.

The XRDY-bar and READY-bar signal lines are connected via a NAND gate to the OPACK-bar input of the 2650 processor, to allow memory cycles to be extended for slow memory. Note that the 2650 does not enter a wait state when this is done, unlike the 8080; in fact the 2650's "wait" state corresponds to the 8080 "hold" state. However, the function of the two S-100 "ready" lines should be unaffected, as these are basically used for memory cycle extension.

Don't forget that in the original 2650 Mini Computer, the OPACK-bar input of the 2650 (pin 36) was permanently earthed. So the copper track of the PC board will have to be cut, to disconnect this earth and allow the pin to be controlled. As the copper track concerned made other earth connections, a wire link will need to be added to maintain these connections.

A flipflop is used in the interrupt logic, as the INTREQ-bar input of the 2650 must be held low until it is acknowledged by a high on the INTACK output. A link (L4) is shown, to allow you to select whether the PINT-bar or VI0 inputs from the S-100 bus are used to set the flipflop and initiate interrupts. As may be seen the flipflop is reset by either INTACK going high, or the reset signal. The latter ensures that the flipflop is always in the reset state when power is applied to the system.

The dashed gate shown in the reset circuitry is actually the 74LS38 gate originally used as an inverter in the reset line of the 2650 Mini Computer. The second input (pin 4), which was originally tied to logic high, is now used to accept the S-100 PRESET-bar signal (pin 75). This allows S-100 plug-ins to reset the system if necessary.

Links L1, L2 and L3 are shown to indicate that you have a choice in deciding which signals to feed out on the S-100 clock lines $\phi 1$ (pin 25), $\phi 2$ (pin 24) and CLOCK-bar (pin 49). As the 2650 does not use the two-phase clock system of the 8080, the choice of signals fed on these lines will depend upon the requirements of the S-100 plugins you want to use.

If the plug-ins basically only use the $\phi 2$ signal as a data strobe, for example (this is fairly common), you will probably find that the buffered OPREQ ("BOPREQ") signal will be most suitable. On the other hand one or other of the S-100 clock signal may be used as a source of synchronised high-frequency signals (say by a video interface board, as a dot shift clock and input to the timebase divider), in which case the 1MHz master clock signal may be more appropriate. Or you may need to provide both BOPREQ and the 1MHz clock, on different lines, for use by different boards. It will depend upon the S-100 boards you are using.

The only remaining point to note about the interface circuit concerns the power supply rails. By convention, S-100 plug-in boards have their own 5V regulators, and are supplied with an unregulated (or only pre-regulated) input of 8V DC. So the main supply rail of the S-100 bus is the +8V line connected to pins 1 and 51, and referred to the ground pins 50 and 100.

The +16V and -16V rails shown on pins 2 and 52 are secondary supply rails, used rather less frequently by plug-ins requiring higher voltage for op amps, D-to-A converters and so on. These boards generally have their own 12V regulators, working from the unregulated 16V lines.

If you don't plan to use plug-ins which require the higher rails, you can forget the +16V and -16V power supplies. All you will need is an 8V power supply, capable of supplying the current needs of your S-100 plugin boards. Needless to say, the ground reference of the 8V supply will need to be connected to the ground side of the existing 2650 system power supply.

Finally, a few suggestions about the physical side of your S-100 interface.

I would suggest that you don't try to design your own interface and motherboard. There are a number of good S-100 motherboards already available, at quite reasonable cost. Similarly there are quite a few S-100 "development boards", complete with gold-plated double sided edge connector pads, and designed specifically to allow you to wire up custom plug-ins.

As both these items are readily available, it seems to me that the easiest way to build your S-100 interface is to wire it up on one of the development boards, with one or more lengths of rainbow ribbon cable to connect the board into your existing 2650 system. The S-100 connections can be made directly to the appropriate edge connector pads, so that the interface board can then be plugged into a standard S-100 motherboard.

This way, you won't have to design or etch any custom PC boards; you'll be using readily-available standard boards. The interface will simply become another S-100 plug-in, which happens to have an "umbilical cord" back into your 2650 system. You also have the option of using a standard S-100 power supply, case and card cage if you wish.

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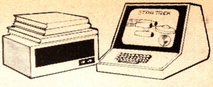

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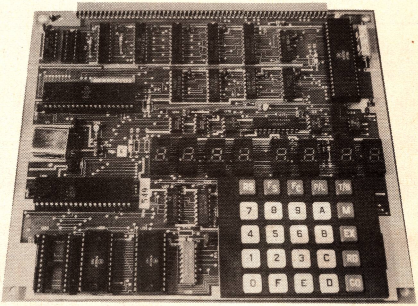

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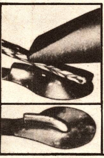

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FINALLY...

We've been able to get more – but limited – stocks of the incredible Word Processor Rom Pac™ for our Sorcerer Computer!

Note: Sorcerer, Video Monitor and printer as shown above are not included in the Rom Pac price!

This word processor system has created a tremendous amount of interest, because of its fantastic performance/cost ratio!

You've seen word processors advertised – they're revolutionising business communications. If you buy a commercial word processor, you get just that: a word processor.

For far less cost than a commercial word processor, you can put your Sorcerer computer to work with the Word Processor PAC™ – and you get a much more powerful word processor system than is commonly available. Here are just some of the features:

1: Automatic text wrap around (sorts continuous copy into lines).
2: Single key commands to get you where you want in the copy instantly: indent, tab, hyphen, scan, as well as up, down, left and right.
3: Single keystroking allowing deletions, expansions, etc.
4: Automatic checking of drastic commands (a boo-boo doesn't become a disaster!)
5: Powerful search functions (search, replace, mark sections, store copy, etc).
6: Autocommands and macro programming (typing mailing lists, for example).

It is features like these which we believe make the Sorcerer Word Processor System OUTSTANDING value for money!

WORD PROCESSOR ROM PAC™

ONLY

$199.00 INCLUDING INSTRUCTION MANUAL!

Cat X-3085

SPECIAL NOTE: The incredibly low price of the Sorcerer Word Processor System is partly because a certain amount of 'do-it-yourself' work is involved for the operation of the system. If you do not have a basic electronics knowledge, make sure you can obtain some basic assistance before purchasing the system.

STOP PRESS

Great news for TRS-80 owners:

How about a light pen for only $29.50!!!!

Yes! We've been able to obtain a scoop purchase of these incredible light pens, direct from the USA, at a fraction of the price you'd expect to pay. Now you can 'draw' on your computer monitor – it's great fun, it's educational, and it's very easy to do!

- **Uses cassette recorder as a pre-amp**
- **Comes complete with cassette containing two application programs: tic-tac-toe (noughts & crosses) game, and 'menu' display routine.**
- **Give your TRS-80 (or Dick Smith System 80) an 'eye'!**
- **Save now: costs only a fraction of other light pens!**

Cat X-3645

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Microcomputer News & Products

AmZ8000 Evaluation from R&D Electronics

Santa Clara, CA . . . June 4 . . . Advanced Micro Computers has introduced the AMC 96/4016, an AmZ8000 Evaluation Board. This product is a fully assembled and tested microprocessor evaluation unit that integrates the necessary on-board software and hardware resources to explore and use the features of the AmZ8000.

In its basic configuration, the AMC 96/4016 incorporates the AmZ8000 16-bit microprocessor; 8k bytes of RAM; 24 parallel I/O lines; two RS232C serial I/O ports; 12k bytes of EPROM/ROM sockets; system clock and resident monitor.

For further information contact R & D Electronics, 257 Burwood Highway, Burwood, Vic 3125. Phone (03) 288 8232.

MICRO Comparisons

Royel Micro Systems Pty Ltd can now supply reprints of two interesting studies on the relative virtues of different microprocessors. The 6500, 8080, 6800 and Z-80 units are covered in the surveys.

Parameters considered include required memory, processing speed, die size, package capability, address modes, internal registers and many more.

The 14 pages of information are designed to help the electronic systems engineer to make the right decisions when designing micro systems, and facilitate selection based on both performance and versatility as well as cost.

Further information from Royel Micro Systems Pty Ltd, 27 Normanby Rd, Notting Hill, Victoria 3168. Telephone (03) 543 5122, or Sydney (02) 709 5293.

Logic Shop

Following hot on the heels of their Melbourne opening, The Logic Shop Pty Ltd has just opened its Sydney store at 91 Regent Street, Chippendale, with Andrew McIntosh as manager.

Like the Melbourne store, the Printerm, Compucolor and Qume daisy-wheel printer feature among the equipment on display, together with the TLS 900 Video Display Terminal, Sendata Acoustic Coupler series, Texas Instruments high speed printers and Houston Instrument models.

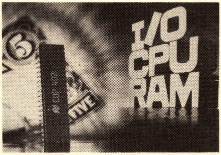
New from National Semiconductor Corp.

Santa Clara, CA — National Semiconductor Corp is now in production with two low cost, four-bit control oriented processors.

Designated the COP402 and COP402M, the 40-pin devices are ROM-less members of National's COPS Microcontroller family, fabricated using N-channel MOS technology.

Each device contains a CPU, RAM and I/O, and is similar to the COP420, except that the read-only-memory (ROM) has been removed. Pins have been added to output the ROM address and to input ROM data.

Both microcontrollers have 64 x 4 bits of on-board random access memory (RAM), and are capable of addressing up to 1k x 8 bits of external data memory. They are designed to operate with up to 1k x 8 bits of external program memory, either ROM or programmable ROM (PROM), for storage of instructions, program data or ROM addressing data.



The COP402/402M devices are aimed at such applications as clocks, timers, lab instruments, radio controllers, appliance controllers, programmable sequencers, scales, cash registers, calculators, microcontroller computational elements, toys, games, and automotive computers.

AND MORE . . .

National Semiconductor Corp has developed the industry's first family of truly microprocessor compatible analog-todigital converters.

The 20-pin dual-in-line ADC0801, ADC0802, ADC0803 and ADC0804 are CMOS, eight-bit, successive approximation converters which use a modified potentiometric ladder similar to the standard 256R approach, and require no external interface logic to operate them with microprocessors.

For total microprocessor compatibility, the ADC0801 family is configured to allow operation with the standard control bus of the 8080 uP derivatives. TRISTATE output latches directly drive the data bus. These A/Ds appear like memory locations or I/O ports to the microprocessor and no interfacing logic is needed.

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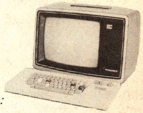
Discount shopping for your professional Microcomputer and terminal requirements

COMPUCOLOR II



features:
Up to 32K User RAM
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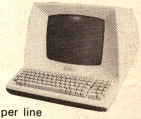

features:
24 lines
80 char. per line
Transmission rates 75-19, 200 Bd.
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features:
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Microcomputer News & Products

Australian Alpha Micro

A new company, Australian Alpha Micro, of 247 Pacific Highway, North Sydney, NSW, has been formed to handle and coordinate the distribution of the US-manufactured Alpha Micro range of small business computers systems in Australia. Mr Peter Martin, managing director of the new company has stated that "Nine distributors and OEM's have already been appointed nationally to sell and provide the necessary backup . . ."

Founded in 1977, Alpha Micro has experienced dramatic growth to the point where its annual sales turnover now exceeds US$5 million. Over 3000 Alpha Micro Systems have been installed worldwide with about one hundred of these sold in Australia (up to mid-November 1979). Alpha Micro's range includes the AM-100 and AM-1000 series computers, disc subsystems, and word processing system and standard software packages.

BS Microcomp gets Commodore PET

BS Microcomp of Burwood, Victoria, announce that they have been appointed as dealers for the Commodore PET range of Microcomputers. The business has been recently established to cater for the rapidly expanding microcomputer market. Full hardware and software support services are provided and the full range of Commodore peripherals is in stock, as well as an extensive software library and a large range of tractor feed continuous stationery, floppy disks and personal computing cassette tapes.

Further information is available from BS Microcomp, 47 Huntingdale Road, Burwood, Victoria, 3125, (03) 288 9129 or (03) 288 9512.

New personal computer from APF Electronics Inc.

Called the "Imagination machine", the APF MP1000 is a personal computer with an accent on graphics and games. As well has having a typewriter console with inbuilt cassette deck, the APF has two numeric keyboard-cum-joystick controllers.

Screen format is 32 upper-case characters x 16 lines, with alphanumerics in three colour modes. Graphics are available in three display modes which enable high resolution and use of up to eight colours. The APF is programmed in Basic language with 9K of RAM. Software is available in cassettes or ROM cartridges.

Price of the APF MP1000 computer is expected to be under $1000 including a full colour monitor. Stocks will be arriving in January 1980. Further information is available from Radio Parts Group, 562 Spencer Street, West Melbourne, Victoria, 3003.

Cottage Computers move house

Cottage Computers, a division of Embryonic Systems Pty Ltd, have moved to larger premises at 386 Queens Parade, Fitzroy North, Victoria 3068. The move was prompted by the very good response to the firm's stand, featuring NPC video cards and Science of Cambridge Mk14 microcomputer kits, at the recent Melbourne Home Computer Show.

Among new lines available in 1980 will be the Clare model 70 keyboard with RS232 outputs and the Acorn range of 6502-based modules.

Decision Data

Following the item on the Decision Data printer from Southwest Technical Products in these columns in the November 1979 issue, Kenelec (Aust) Pty Ltd has advised that they are local distributor for Decision Data Products and can provide full technical support.

ECS Microsystems opens in USA

ECS Microsystems, one of Australia's leading communications systems manufacturers has moved its manufacturing and marketing headquarters to the USA's Silicon Valley in a $3.5 million move. The company expects to employ 250 people in the USA by the third quarter of 1980.

Forbes Data Systems

COMPUTER COURSES

Microcomputers used extensively in the classroom — hands-on experience.

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THE COMMODORE PET is a completely self-contained personal computer. Just plug in, and within a few short hours even the complete novice will be amazed at what can be done. The 8K model shown, 16K & 32K models are now available and options available are External Cassette Decks, Dual Drive Intelligent Mini-Floppies and Printers. The 8K, 16K & 32K models are expandable up to 40K of RAM via plug-in memory boards. For a review of the PET see May 1979 E.T.I.

PET FOOD: A large range of programs including games, educational programs, business applications, and .even a program to teach yourself Basic, are now available.

TRENDCOM PRINTERS: These high performance Thermal Printers print the full set of alpha-numeric characters at 40 characters per second. Trendcom 100 is a 40 character-per-line printer, Trendcom 200 is an 80 character per line printer and prints graphics. Interfaces for PET, TRS-80, APPLE and SORCERER available.

We handle the complete TRIO test equipment range. The CS-1352 Dual Trace CRO pictured above features 15MHz bandwidth, 2mV/div, 0.5S to 0.5uS/cm, and AC-DC-battery operation. $740 includes rechargeable batteries. PC-29 probes to suit CS-1352 $32.00 each. B&K instruments available at competitive prices — 1077 BC PAL television analyst $693.00.

SPECIAL

G.E. PAR 38 100W COLOURED FLOODS

Made in USA, ES Mount.

1-11 **$5.50ea**
12 + **$5.00ea**

Red, Blue, Green, Yellow — Please specify colour.

All prices include Sales Tax and Road or Rail delivery to your door/nearest railway station. Extra Information is available and we invite your enquiries. Please note that all prices, details and predicted availability were correct at time of going to press.

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COMMODORE CBM — THE COMPACT COMPUTER FOR BUSINESS FOR HOME USE

All components are complete — No extras necessary

32K CBM Processor — Price: $2199.00
16K CBM Processor — Price: $1829.00

Keyboard	**— Full Cursor control. — 74 Keys. — Upper and Lower Case Characters plus full graphics.**
Memory	**— RAM - 16K or 32K expandable to 44K. ROM - 14K including BASIC interpreter, operating system and machine language monitor.**
VDU	**— 1000 characters (40 x 25) — 8 x 8 Dot matrix for characters. — 64 standard ASCII characters + 64 graphics characters — all characters displayable in reverse field.**
Additional Features	**— Programmable IEEE-488 interface port for up to 15 intelligent devices. — 2 cassette interfaces built in. — Mapped screen memory (1K). — Memory mapped I/O user port.**

We provide full software and hardware support for all our product range. A large variety of software is now available for the Commodore range including a disk based Word Processor package and a complete General Ledger package developed in Australia to suit local requirements. The usual variety of games programs (including Microchess and Backgammon) and a large number of educational programs are now available and more are being written all the time. We also stock continuous stationery suitable for all types of tractor feed printers and have a complete selection of floppy and mini floppy disks and personal computing cassettes.

Dual Drive Floppy Disk — Price: $2099.00

Featuring — 340K bytes storage on 2 single sided single density 5¼" floppy disks.
— DOS resides in unit — occupies none of CBM memory.
— Extensive file and data manipulation Command Set.
— Intelligent device capable of processing data independently of the CBM.

Tractor Feed Printer — Price: $1699.00

Featuring — Completely programmable — allows you to vary character size, define your own characters, vary data format and line spacing.
— Intelligent device — capable of printing while CBM does other work.
— 6 x 7 dot matrix print head — prints all CBM characters and graphics.
— Fully adjustable for paper width up to 10".
— Prints 70 lpm or 150 cps (burst speed).

ALSO AVAILABLE —

8K PET Personal Computer with integral cassette unit. Offers all the capabilities of the 32K or 16K at a new low price — ONLY $1199.00 complete — includes $200 worth of software and $15 book "Hands on BASIC with a PET".

For further information contact:—

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AIM 65

DWELL
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ROCKWELL AIM 65

AIM 65 is fully assembled, tested and warranted. With the addition of a power supply, it's ready to start working for you AIM 65 features on-board thermal printer and alphanumeric display, and a terminal-style keyboard. It has an addressing capability up to 65K bytes, and comes with a user-dedicated 1K or 4K RAM. Two installed 4K ROMs hold a powerful Advanced Interactive Monitor program, and three spare sockets are included to expand on-board ROM or PROM up to 20K bytes. (4K assembler, 8K basic optional). An Application Connector provides for attaching a TTY and one or two audio cassette recorders, and gives external access to the user-dedicated general purpose I/O lines. Also included as standard are a comprehensive AIM 65 User's Guide, a handy pocket reference card, an R6500 Hardware Manual, an R6500 Programming Manual and an AIM 65 schematic.

AIM 65 1K RAM5 $525 TAX PAID
4K RAM $570 TAX PAID
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4K ASSEMBLER IN ROM $100
CASE TO SUIT $75

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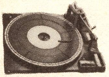
SPECIAL PURCHASES

NEW B.S.R. RECORD CHANGERS-PLAYERS



MODEL C197

$47.50

This is a new model just released and is fitted with a ceramic cartridge & diamond stylus. Auto or manual operation: Three speed 33, 45 & 78rpm: Cueing control and bias compensation: Changer & player spindles supplied: 11" turntable. **Post & packing extra, NSW $2.75: Vic, Qld $3.75: WA, NT & Tas $4.75.**

SPEAKER GRILLE FABRIC AT ½ PRICE

AVAILABLE IN BLACK, BLACK WITH GOLD FLECK, LIGHT & MID BROWNS. WIDTH 60in.

$4.80 Per YARD. Post & Pack $1.75.

Send two 20c stamps for samples.

GARRARD CC10A RECORD CHANGER

$15.75

Fitted with a Sonatone Garrard Ceramic Cartridge Sapphire Stylus supplied with template & instructions. Posts & Packing: NSW $2.50. Inter. $3.50.

MODEL C142R

HI-FI UNIT WITH ADC MAGNETIC CART & DIAMOND STYLES

$55.00

A precision automatic and manual record-playing unit fitted with 4 pole motor to provide constant speed conditions for the 11½ inch turntable. The low resonance tubular pickup arm is counter-balanced with a resiliently mounted weight to permit light sensitive tracking, and the slide-in cartridge carrier enables styles inspection and the interchange of replacement of cartridges to be carried out simply and quickly. Fine stylus force adjustment and bias compensation are both calibrated for accurately setting the arm to given optimum playing conditions for the chosen cartridge.
The fluid-damped level-type cue and pause control ensures gentle lowering of the pickup to the surface of the record. A short spindle is supplied for single record play records. Precision engineering is reflected in the styling of the 142R, which is elegantly finished in black and silver.

POST AND PACKING EXTRA

NSW $3.75
Tas, WA & NT $7.00
Vic, SA & Qld $5.75
(Reg. post $2.00 extra)

NEW RANK-ARENA F.M.-A.M. TUNER AMPLIFIER

MODEL RA402. Output 24 watts RMS. (12+12). Response 50HZ to 50KHZ. Mag or ceramic inputs. High & low filters. Loudness control. Provision for 4 speakers.

Freight Extra.

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NEW E.M.I. AND HITACHI RECORDING TAPE AT BARGAIN PRICES

HI-DYNAMIC EMITAPE — HIGH OUTPUT — LOW NOISE — HI-FIDELITY

HLP18 7" reel 1800ft. long play $5.95
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P & P —

NEW E.M.I. SUPE C90 CASSETTES, 5 FOR $10.00. *P&P $1.00*
Hitachi LN 8-track 90 minute cartridge. 5 for $10. *P & pack $1.50.*

NEW AWA HI-FI SPEAKER KITS 8" 2 WAY 3 SPEAKER SYSTEMS

AT LESS THAN ½ LIST PRICE

POWER RATING 20 WATTS R.M.S.
IMPEDANCE 8 OHMS
FREQUENCY RANGE 46 TO 18000 CYCLES

Supplied in kit form (less cabinet) each kit comprises: One AWA 8WAC 8in. bass unit, two AWA 4MBC 4in tweeters with ceramic magnets & curve-linear cones, crossover components, grille cloth, innabond lining and cabinet plans.

CABINETS AVAILABLE
Post & packing extra, NSW $2.50, Interstate $3.50.

$18.50 Per Kit

NEW GOODMAN-FOSTER 3-WAY 4-SPEAKER HI-FI SYSTEM

$39.00 PER KIT

Frequency Range 45 to 22,000 cycles. Power rating 25 watts. RMS Imp-8ohms. Supplied in kit form (less cabinet) each kit comprises two English Goodman 8" bass units. Foster 5" mid range. Foster 1" dome tweeter crossover components Ocodensers and inductance innabond, speaker fabric and plans of cabinet. Cabinet dimensions 23" x 13" x 10". **CABINETS AVAILABLE.**

Post & packing extra: NSW $2.70; VIC, SA, QLD, $4.70; WA $5.70. (REGISTERED POST $2.00 EXTRA IF REQUIRED) cabinets available.

NEW HOKUTONE HI-FI SPEAKER KITS AT A FRACTION OF LIST PRICE

NEW THREE WAY HIGH FIDELITY SPEAKER SYSTEM WITH A FREQUENCY RANGE OF 35 TO 20,000 CYCLES. POWER RATING 50 WATTS.

Supplied in Kit form (less cabinet) Woofer HFW-302, 12". Mid range HM-24 dome. Tweeter HT-60 dome. Three way crossover with separate controls for mid range & tweeter. Innabond lining, grill fabric & cabinet plans supplied Cabinet dimensions 668 high, 435 wide, 310 deep.

$69.00 per kit

Freight extra by rail, air or road transport.

NEW GARRARD 6-200 CP RECORD PLAYERS

Fully automatic turntable automatically or manually as required. 11" turntable. Cue & pause control. Record speeds 33 1/3, 45 and 78 rev/min. Finished in black with silver trim. Fitted with ceramic cartridge. Post & packaging extra. NSW $2.70; Vic, Qld; SA $3.70; WA $4.70 (registered post $2 extra if required).

$34.00

RANK-ARENA 2 WAY SPEAKER

- 10 Watts RMS
- 8 ohm impedance
- 8" woofer with tweeter
- Supplied with lead and plug
- Teak finish

$42.00
PER PAIR

Dimensions 18"H, 11"W, 9½"D
Freight extra per rail air or road transport

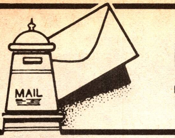
NEW CAR CASSETTE CONVERTERS BICOH MODEL NA100/CC-007A AT APPROX. ½ LIST PRICE

By connecting this model with your existing AM car radio, you can enjoy the music of any cassette that has been pre-recorded.
Connection requires no alteration to the car radio. Plug your car aerial into the cassette recorder and using the patch cord supplied, connect the recorder to the aerial connection of your car radio. By following the instructions, installation is a **simple procedure. All cords & brackets are supplied. Can be used in any car with a 12-volt neg. earth** system can also be used with any AM radio by using a 12V supply.
Dimensions: 150 x 110 x 53mm.

$18.50
post & pack
$1.50 extra

CLASSIC RADIO

245 PARRAMATTA RD, HABERFIELD 2045. PHONES 798-7145, 798-6507.



Letters to the editor

Loud music: no worries mate!

I'm sick of seeing loud music condemned, especially by people in the privileged position of audio journalist. Loud music is not only aurally stimulating but physically satisfying as well.

I draw your attention to an extremely interesting article in Australian HiFi Vol 10 No 8 on the hearing loss of rock musicians. I myself am a rock musician as well as a professional hifi salesman, so I feel myself better qualified to speak on the matter than somebody who rarely has his stereo above 90dB.

I feel that sound is not strictly hifi unless it is replayed at the level at which it was originally performed.

The ear is a lot more protective of itself than most people realise. We do not know all the answers so why be so dogmatic. I am not going deaf! Once again, I draw your attention to the above mentioned article.

Chris Darker,
Esperance, WA.

COMMENT: Had your hearing checked lately? I say . . . HAD YOUR HEARING CHECKED LATELY? Yes, the ear does protect itself from loud noises — by going deaf.

White elephants & dual gate mosfets

The article in the July issue of "Electronics Australia" concerning the Quartz Multiple Frequency Reference, by Ian Pogson, is a good idea. It will make a valuable piece of test equipment for any hobbyist's work bench.

I have completed this project except for one small problem which cannot be eliminated. I now have what is termed a "white elephant".

The problem lies in the fact that I cannot purchase from any distributor the BFR84 dual-gate MOSFET. I have contacted Philips and have been informed that there are no stocks in Brisbane or Sydney, and have not been any for a couple of months. They also informed me that they did not know when they would be getting fresh stocks of this transistor as it is not in high demand.

I also contacted Dick Smith Electronics, Delsound, Cema Pty Ltd and R. A. Venn Pty Ltd, who are all agents for Philips, to no avail. In desperation I contacted Techniparts, Brisbane, (National Semiconductor agents) to see if they had an equivalent, but was told the same story.

It has proven to be a waste of time, effort and money to build this piece of equipment if I cannot use if because of a 60c transistor.

Perhaps you may be able to redeem my faith in your magazine by informing me where I could possibly purchase this transistor.

M. Walker,
North Ipswich, Qld.

COMMENT: You can buy the BFR84 dual-gate MOSFET from at least one supplier: Radio Despatch Service, 869 George St, Sydney, NSW 2000. Telephone 211 0191.

Beryllium oxide: the alternatives

I am undertaking construction of a solid state air-conditioner after reading your article on Peltier devices in the August 1979 issue. However, seeing a fan is used on the heatsink, I was wondering if you could tell me some brands of heatsink "goo" which do not contain BeO. This is important because when heatsink "goo" containing BeO is disturbed, nasty things happen.

Tim Sangster,
Canterbury, Vic.

We have recently been made aware by Telecom Australia and others in the electronics field of the dangers associated with the use of beryllium oxide in certain components and ancillary products.

It should be very important for technicians and others who may be handling servicing materials, in particular heat transfer compounds, to know that at least one such product — GS13 — manufactured at our Brookvale plant does not contain beryllium oxide.

We feel that those in the electronics industry should be made aware that there are comparatively "safe" materials available to them.

N. Blackler, Marketing Officer,
Bevaloid Australia Pty Ltd,
Brookvale, NSW.

COMMENT: The Bevaloid GS13 heatsink compound referred to above is distributed by Watkin Wynne Pty Ltd under the brand name "Gensil". It is available from the following retail outlets: Sydney — David Reid Electronics, Standard Components; Melbourne — Radio Parts Group, J. H. McGrath, and Ellistronics; Adelaide — Gerard & Goodman, Protronics; Brisbane — Delsound, Audiotronics; Perth — Atkins Carlyle.

Further, Thermalloy Thermalcote heatsink compound, which is claimed to be nontoxic, is distributed by Soanar Electronics Pty Ltd.

We hope that all manufacturers of heatsink compound will state the constituents on the packaging before long.

Notes & errata

Re your editorial "Putting things in perspective". Here's a suggestion: index the notes & errata in your March issue. Reason? When you start a project it sure would be nice to have a ready reference to the errors. It will only cost you a few centimetres and be a real fine service to your readers.

R. Cook,
Downer, ACT.

COMMENT: We'll keep it in mind, but they may not be complete. Errors may not become apparent until months after the article — and the Index — has been published.

Anonymous critics

Many thanks for speaking out against the anonymous critic referred to in your recent editorial. You may be assured that a great percentage of your readers are newcomers. Also, you may be assured that most new readers are given their baptism into EA by these same newcomers. Most advanced readers don't generally bother to talk to the new chums.

I have purchased every copy of your magazine for the last 14 years and enjoy reading same. Electronics to me is a hobby — perhaps you could say I am still a newcomer.

Keep your magazine going as it is. I suggest that you revert back to not replying to anonymous critics.

J.H. Howard,
Fairlight, NSW.

COMMENT: As you can see, we have kept the newcomer articles coming, and will continue to do so. Thank you for your letter.

REVIEWS OF RECENT

Records & Tapes

CLASSICAL • POPULAR • SPECIAL INTEREST

Chopin — "in a completely new light"

CHOPIN: Nocturnes, Vol. 2 Fou Ts'ong, piano. Odyssey Stereo disc ODA 5130.

This disc contains Nocturnes Nos. 9 to 18 — a very generous offering indeed; in the repertoire of most concert pianists, these are regarded as being the final 10 of Chopin's Nocturnes, although there are, of course, three more: opus 72 and two posthumous ones, rather rarely heard. To my knowledge, the only recording of all 21 of them is the Alexis Weissenberg set, attractive, romantic, well done indeed.

The Chopin interpretations which I was brought up to think of as "right" are probably best personified by Rubinstein and I have accepted the view that they correspond closely to a pianistic and musical tradition which may be traced right back to the composer himself. At the same time, there were occasional rumblings in Poland which called this tradition heretical. Fou Ts'ong, who received much of his training in Poland, presents a view of Chopin which is certainly very different from Rubinstein's. The first impression is bewildering; his playing seems prosaic, even dull — but closer attention shows a very different canvas, a very convincingly different Chopin.

The C minor Nocturne of opus 48 No. 1, the first of the very serious later works, is a good example for closer study. Fou Ts'ong adopts a much slower tempo than Rubinstein, his playing is less obviously rhythmic; there is more grandeur, almost weightiness, never even a hint of thumping, far more music. On balance, this is the difference throughout: Fou Ts'ong offers far less excitement, but very much more music. Beautiful playing, excellently recorded, of works which now show up in a completely new light; whatever the first record in this set was like (I have not heard it), volume 2 is something no lover of Chopin's music can afford to neglect. (P.F.)

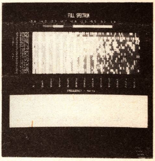
Varese: "deserves widest attention"

VARESE: Ameriques; Ionisation; Arcana. New York Philharmonic, conductor Pierre Boulez. CBS Stereo disc SBR 235956.

Edgar Varese was born in France in 1883; he moved to the US in 1915, came to be regarded as one of the country's most startling and revolutionary composers and died in New York in 1965. His music remains little-known; this is the first disc containing work of his I've ever seen and live listening for five decades gave me acquaintance with just two short works of his, significantly performed by the London Sinfonietta and the Seymour Group respectively.

According to the textbooks, what distinguishes Varese's music is his method of allowing each individual instrument to be heard as the source of a unique sound-character; one English critic has tagged it a "polyphony of timbres". It so happens that the three works on this disc — written in 1918/22, 1925/27 and 1931 respectively — do not sound anywhere as revolutionary as they must have done on first performance: I am aware that they created sensations and much controversy. Four decades later, a degree of affinity with Stravinsky is obvious, the music is by no means difficult to listen to, yet remains of very great interest.

All three works heard here employ enormous percussion resources. Ionisation is for 37 percussion instruments, plus piano; the other pieces employ a full, and augmented, orchestra. Ameriques is far from being structureless and even the later works never approach the type of avant-garde nonsense that we are now hardened to. The playing, under Boulez, is exemplary, the recorded sound is simply magnificent; I think this recording deserves the widest attention and should please all serious students of recent music, as well as percussion enthusiasts, who will hear some decidedly novel sounds. (P.F.)



Australian digital music

FULL SPECTRUM. Australian Digital Music. Works by Percy Grainger, Tristram Cary. Warren Burt, Barry Conyngham and Darius Clynes. Move stereo disc MS 3027 (from Move Records, Box 266, Carlton South, 3053).

It seems a reasonable assumption that most readers of this magazine are fairly clued up about electronics and there is a vast amount of information accompanying this disc which they will appreciate. In addition, anyone who is "in to" electronic music will surely be delighted; this is a beautifully made recording, with fine, clean sound and with contents sufficiently varied to satisfy anyone.

Your reviewer, alas, knows naught about electronics and his interest is purely musical . . . Digital or not, I found many of the sounds here recorded to be musically valid and of some interest; I am not quite sure why anyone would want to produce a computer-synthesised facsimile of the human voice, but it is done and with eerie effect. The Grainger track, less than two minutes of it, is a first attempt to realise some of this composer's ideas which he recorded in a graphic form, lacking the equipment which could have produced the sounds he wanted in the mid-thirties. The recorded sounds and the notes are wholly absorbing and I recommend the disc to all those who can still cope with novel experiences. (P.F.)

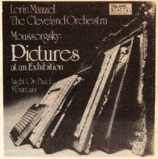
MOZART: Idomeneo (Highlights). Wieslaw Ochman & Peter Schreier, tenors; Edith Mathis & Julia Varady, sopranos; Hermann Winkler, bass; Leipzig Radio Chorus; Staatskapelle Dresden; conductor Karl Bohm. DG Stereo Disc 2537 051.

Idomeneo, Mozart's only tragic opera, was hardly known 30 years ago; now it has returned to the repertoire all over the world and is generally accepted by audiences, irrespective of its dramatic shortcomings, simply because it abounds in superb music. For this same reason, it is quite particularly suited to radio and the gramophone record.

The recording here presented (presumably it was made in Dresden) is remarkably fine in every technical detail; more surprisingly, it is just as outstanding musically. Bohm has often seemed much too slow and tired in recent years, but he drives this score at a good pace, without flagging. The soloists are excellent — particularly the two tenors — and both orchestra and choir perform faultlessly. It is good to have this evidence of musical co-operation between East and West; my only regret is that it was "highlights" — my appetite has now been whetted for the complete recording! (P.F.)

☆ ☆ ☆

PICTURES AT AN EXHIBITION — PHEW!



PICTURES AT AN EXHIBITION; NIGHT ON BALD MOUNTAIN; Moussorgsky. The Cleveland Orchestra conducted by Lorin Maazel. Digital master stereo, Telarc 10042. (From PC Stereo, PO Box 272, Mount Gravatt, Qld 4122.)

"Phew" is the word which best summed up my reaction as the last massive stanzas of "pictures" faded into silence. Prior to that, the room had been shimmering to the wind and the strings of the Cleveland orchestra and literally quaking to the thud of the big drums.

Exaggerated language? I'll leave you to judge that for yourselves if you ever get to hear this new release from Telarc.

It opens with Rimsky Korsakov's orchestration of "Night On Bald Mountain" (10½ mins), followed by the first two pictures. Side two opens again with promenade and leads on to the remainder of the well known Moussorgsky-Ravel composition.

The performance in the Masonic Auditorium (Cleveland, Ohio) was captured on a Soundstream digital recorder and mastered in the JVC cutting centre. One look at the disc is sufficient to indicate that the automatic pitch control has been used to the full — closing up the grooves during the soft passages and opening them wide to accommodate the crescendos and the massive bass.

Full marks must go to the orchestra and its resident conductor for an exhilarating performance of the time-honoured duo and to the team which finally fitted it all into one of those time-honoured analog grooves.

I can only add my verdict to those of a number of overseas reviewers: a beauty, "fabulous", "historic", etc. (W.N.W.)

RESPIGHI: Ancient Airs and Dances. Boston Symphony Orchestra, Seiji Ozawa, conductor. DG Stereo Disc 2530 891.

I think it would be fair, on the strength of his recorded repertoire, to describe Ozawa as a conductor specialising in recent music — he has done some very fine work with Honegger, Lutoslawski, Janacek as his task. Respighi's "free transcriptions" of lute music from the 16th and 17th centuries were never very avant-garde and it may be that the music has little appeal to Ozawa — a very volatile conductor and one who, when observed, appeared to be a little superficial.

It will be clear that I am trying to find why this recording is a disappointment to me. The music in the three Suites, which is by no means often heard, is as beautiful as ever it seemed and I cannot say that the Boston players have lost any of their skill or innate musicianship; besides, the recording is well made, the surfaces are clean and if I deplore a bass bias, a favourite of the percussion in particular, this may well be exactly what Ozawa wanted. And I think that all my objections finally come to this: I don't care for Ozawa's way with the music!

Having said this, I must be specific: tempi are decidedly on the slow side. I compared Ozawa's reading of the lovely Siciliana in the 3rd Suite with that recorded by the Los Angeles Chamber Orchestra under Marriner: they took 35 seconds less for the music, played it without any thumping and with a sweeter tone. Ozawa, seduced perhaps by the larger orchestra's resources, endows everything with solid, heavy rhythms, dramatises what ought to sound simple and gives a, generally, heavy-handed account of the score. Some may like it — I don't. (P.F.)

☆ ☆ ☆

CHOPIN: Piano Concerto No. 1 in E minor, op. 11. Krystian Zimerman, piano; Los Angeles Philharmonic Orchestra, conductor Carlo Maria Giulini. DG stereo disc 2531 125.

Zimerman is one of the more recent arrivals among the keyboard virtuosi, a winner of the Warsaw Chopin Prize and, as such, invites comparison with Maurizio Pollini who, after winning the same contest, recorded this concerto with the Philharmonia, conducted by Kletzki. The comparison is a very valid one as both artists have a similar attitude to Chopin: meticulous attention to style, elegance of touch and phrasing and avoidance of all excess.

On purely pianistic grounds, then, no one owning and loving the Pollini version need feel any great urge to acquire this one; moreover, Giulini and Kletzki also seem in fairly close agreement on tempi, phrasing and balance.

Where some preference might enter is in the orchestral sound and the degree of clarity; the new DG disc is quite markedly superior in purely acoustic quality and although the Los Angeles recording was made live (or, indeed, possibly just because of that!) there is what appears to be better orchestral playing to be heard on the newer release. (P.F.)

☆ ☆ ☆

BEETHOVEN: Piano Concerto No. 5 in E flat major Op. 73. Emil Gilels and The Cleveland Orchestra conducted by George Szell. World Record Club stereo R 00639.

This could hardly be a new recording, as George Szell died in July 1970. In fact it was recorded in 1969, in a joint EMI-CBS effort, and WRC has done us all a favour by reissuing the results.

The Emperor concerto is a most majestic and moving work, and Gilels and Szell really turn in a memorable performance. The orchestra plays with precision and zest, while Gilels makes the piano part fairly glow with a controlled but vibrant energy.

The recording is a little dull by modern standards, and I would have preferred slightly greater emphasis on the piano in some sections. But on the whole it is quite clean, and perfectly acceptable.

If you don't have a recording of the Emperor, this one would be well worth a hearing. If you already have others, here's your chance to get a copy of this historic reading. (J.R.)

Reviews in this section are by Paul Frolich (P.F.), Neville Williams (W.N.W.), Jamieson Rowe (J.R.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), Greg Swain (G.S.), and Danny Hooper (D.H.).

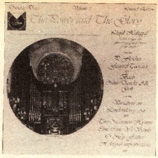
Notable organ recordings

THE POWER AND THE GLORY, Volume 2. Lloyd Holzgraf playing the organs of the first Congregational Church, Los Angeles. Stereo, direct-to-disc, M&K Realtime RT-113. (From M.R. Acoustics, PO Box 165, Annerley, Qld 4103.)

The same organist and the same three organs in the huge Los Angeles Church are featured here as in the first volume, reviewed recently. And the 11,848 pipes, including multiple 32ft ranks produce the same massive sound which caused one EA staff member to liken it to "a recital on Vales Point" (one of the huge power stations feeding Sydney).

While smaller, less pretentious instruments may appeal to many as being more "musical", there can be no doubt that these acoustic monsters are impressive.

The program is a complete change from Volume one: "Festival Toccata" (P. Fletcher); "Nun Danckt Alle Gott" (Bach); "Variations on Londonderry Air"; Two Mormon Hymns, "Come, Come Ye Saints" and "O My Father". The material on side two may appear to be unambitious, but Lloyd Holzgraf's variations on the melodies leave few tones unturned!



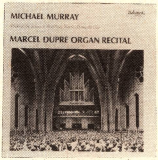
The recording itself is very clean but the thunderous bass overwhelms the treble, on occasions, in sheer sonic power. Perhaps it's significant that the jacket notes suggest that it may be an advantage to reduce the level of the bass by 6 to 9dB; what heresy to lovers of the big pipes!

If you liked Volume one, you'll like this one too. If it's a matter of choosing one or the other, base your choice on the content. (W.N.W.)

MARCEL DUPRE ORGAN RECITAL. Michael Murray at the organ of Basilique Notre-Dame du Cap. Advent stereo 5014. (From P.C. Stereo, PO Box 272, Mount Gravatt, Queensland 4122.)

Michael Murray is one of the most impressive of the new generation of American concert organists, and has drawn glowing praise from his recitals in both America and Europe. He studied under Marcel Dupre in Paris for two years, and obviously identifies closely with the master and his music — although he has also been highly praised for his playing of Bach.

Here he plays some of Dupre's most moving and impressive works, on the equally impressive 1963 Casavant Freres three-manual organ in the Basilica of Our Lady, Cap-de-la-Madeleine, Quebec. The pieces played are as follows: Cortege et Litanie (Op. 19, No. 2); Choral et Fugue (Op. 57); Musette (Op. 51); I Am Black But Comely (Op. 18); Prelude and Fugue in G minor (Op. 7 No. 3); Elevation (Op. 32 No. 1); and Final (Op. 27, No. 7).



As one might expect he plays them with great style and sensitivity, not to mention a flawless technique. Here is French Romantic organ music at its best, particularly when played on an instrument which seems to possess only the best characteristics of the type of organ for which the music was written. The Cap organ is capable of enormous dynamic range, yet its pipes sing clearly and sweetly in the best Cavaille-Coll tradition — none of the soupy moo-ing that drove this school of organ building into later disrepute.

Advent's recording is of a very high standard, too. No distortion is evident in the forte sections, while the quiet passages are still well above the tape and surface noise. Clarity and definition is outstanding.

If you're partial to well-played Romantic organ music, I wouldn't miss this one. (J.R.)

☆ ☆ ☆

THE JACQUES LOUSSIER TRIO plays Bach's Brandenburg Concerto No. 5. The Jacques Loussier Trio with the Royal Philharmonic Orchestra. World Record Club stereo, R 05538.

In my experience, you either like the Jacques Loussier Trio very much, or you can't stand them. Some people really enjoy the Trio's free-flowing jazz based on Bach, while others (especially those who like Bach) would rather listen to the original, or keep their Bach and their jazz in separate compartments.

If you're a JLT lover and you liked their earlier Play Bach recordings, you'll almost certainly like this one too. The arrangements of the 5th Brandenburg Concerto are fresh and imaginative, and you get arrangements of the Air on the G string and the Prelude No. 2 in C minor as well.

The first movement of the concerto is a little marred by over-close miking of the percussion, but otherwise it's fine. (J.R.)

☆ ☆ ☆

RHAPSODIES, RICK WAKEMAN. A&M L70121/2 Festival release.

Rick Wakeman's keyboard skill is well to the fore in this double album, with some of the themes borrowed from the classics such as Gershwin's Rhapsody In Blue, Summertime and Tchaikovsky's Swan Lake. The sound

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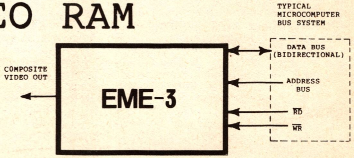

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quality would put the record in the "Demo" class.

The 18 tracks include: Bombay Duck — Animal Showdown — Big Ben — Rhapsody In Blue — The Pulse — Swan Lager — March Of The Gladiators — The Flasher — The Palais — Sea Horses — Half Holiday — Summertime.

Don't be tempted to play the album all the way through at one sitting, as the fairly dominant percussion line becomes a bit much after a while. (N.J.M.)

☆ ☆ ☆

THE BEST OF THE ROGER WAGNER CHORALE. World Record Club WRC S/5289.

When I played this album I had the feeling that, somewhere along the line, I had heard a lot of it before. But this does not diminish the enjoyment of listening to one of the best choirs around in 14 all-time favourites, including: The Wide Missouri — On Top Of Old Smokey — Were You There? — Deep River — The Lord's Prayer — The Song From Moulin Rouge — Beautiful Dreamer — Ave Maria — O' Bury Me Not On The Lone Prairie.

The age of some of the tracks can be guessed from they fact that the were originally in mono and are recorded on this disc in "Duophonic" sound, whatever that may be. (N.J.M.)

☆ ☆ ☆

GOULD PLAYS GOULD. MOVE MS 3021 (Move Records, Box 266, Carlton South, Vic 3053).

Australian pianist Tony Gould teams up with other local musicians of the calibre of John Sangster and Ray Martin and the Sydney Pro Musica Strings to

Devotional releases

WOOD BETWEEN THE WORLDS. Bob Ayala Myrrh MSB 6608 (From Word Records Aust, 18-26 Canterbury Rd, Heathmont, Vic 3135).

The unusual title of this album refers to the Cross of the Crucifixion bridging the gap between the world of men and the world of God. The sleeve carries all the lyrics, together with their source verses of the 10 tracks: Empty Cup — That Hideous Strength — Nicodemus — Red Letter Edition — Babylon — Tammuz Celebration — I Need Love — Pamela — Born On Easter Morning — Prelude To Flight — Wood Between The Worlds

The music is a mixture of soft rock and country & western, easy to listen to and you don't miss any of the words. The quality is good. (N.J.M.)

☆ ☆ ☆

FAVOURITE SACRED SONGS. Vera Lynn, with the Mike Sammes Singers, arranged and conducted by Johnny Douglas. Stereo, World Record Club WRC-R-04465.

Originally released by EMI/Columbia, this recording dates back to 1972 — recent enough to suffer no special problems with recording quality.

Vera Lynn is probably best known for her wartime songs and by her title of "The Forces Sweetheart". In this album, she offers 11 sacred songs, in collaboration with chorus and orchestra: Bless This House — O Perfect Love — Whispering Hope — The Old Rugged Cross — At The End Of The Day — Abide with Me — The Bells Of St Mary's — Amazing Grace — The Village Of St Bernadette — Walk With Faith In Your Heart — The Holy City.

The whole presentation is characterised by sensitivity and sincerity and, if you're in the age group which responds to these old favourites, you'll certainly enjoy this performance by Vera Lynn. (W.N.W.)

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produce some very original music in the jazz idiom.

Side one consists of four movements; Brown — Hounslow — Sangster — Barnard, some of it almost chamber music in style, with a hint of Highland influence on one track. Side two is a recap of some of the themes developed one side with Tony Gould on Piano and John Sangster on Vibraphone without the string backing.

The whole record makes for very enjoyable listening, with excellent sound quality. (N.J.M.)

☆ ☆ ☆

DOUBLE OR NOTHING. Lani Hall. A & M Records L 36936. Festival release.

Lani Hall is Herb Albert's wife. He assisted her by producing most of the 10 tracks on this album. Lani Hall's vocal abilities lie somewhere between Barbara Streisand and Cher, and her voice is every bit as good as the musical arrangements.

The album contains music in various moods, ranging from slow ballads to "light" disco. All in all, an excellent delivery.

The tracks on this album are: Nobody Gets This Close To Me — Shot In The Dark — Meni Devol — To The Morning — Sailing Without A Sail — Double Or Nothing — Sunshine After The Rain — To Know — So Long — Magic Garden. (D.H.)

BRENDA RUSSELL. Brenda Russell. A & M Records L 37063. Festival release.

This is Brenda Russell's debut solo album. However, she has been on the music scene for around a decade and has performed and recorded with such artists as Elton John, Bette Midler, Barbara Streisand, Neil Sedaka and Robert Palmer.

Brenda has created a lively, unpredictable album that blends elements of pop, funk and R & B.

The eight tracks on the album are: So Good, So Right — In The Thick Of It — If Only For One Night — Way Back When — A Little Bit Of Love — You're Free — Think It Over — God Bless You. (D.H.)

☆ ☆ ☆

WE SHOULD BE TOGETHER. Crystal Gayle. United Artists L 36952. Festival release.

One of Nashville's top country performers is Crystal Gayle and this album confirms her position as one of the leaders in the field. The 10 tracks on this refreshing album range from soft love ballads to upbeat country:

Sneakin' Out The Back Door — You'll Be Loved Some Day — Beyond You — The Best Thing In My Life — Time Will Prove That I'm Right — Your Kisses Will — Your Old Cold Shoulder — Through Believing In Love Songs — Too Deep For Tears and We Should Be Together. (D.H.)

Cassettes for discussion groups . . .

YOUNG PEOPLE AND SOCIETY. Dr John Edgar. Mono, cassette. (From Move Records, Box 266, Carlton South, Vic 3053.)

Dr John Edgar is Reader in sociology at La Trobe University in Victoria. In this 40-minute cassette he talks about the conclusions drawn from an extensive survey of 14 and 15-year-olds widely dispersed across Victoria. During the survey, considerable contact was made also with parents, particularly fathers.

Earlier, I used the word "talks" quite deliberately because, although delivered to an audience, there is no sense of it being a "stand and deliver" lecture, full of drama and revelation.

Mainly it's just plain commonsense, with a strong plea for "positive feedback" which will reinforce those areas where individual adolescents are most likely to succeed; and for understanding and parental guidelines within which young people can learn to make their own choices.

As I said, commonsense — with enough angles to prompt group discussion across a wide age range. (W.N.W.)

MARRIAGE. Stereo cassette, also from Move Records.

According to information on the title card, this cassette is part of a marriage kit put out by Dove Communications, Melbourne. Without having seen the kit, my impression is that the tape itself would provide thought provoking material for a discussion group.

Running for about 50 minutes it contains segments: Thoughts on marriage — Marriage Greek style — Trial Marriage — After Four Years — After 13 Years — What Is Liberation — Better Take A Book To Bed.

None of this is lecture material. It's mainly low key chat between partners involved in the various situations, who manage to leave the subjects fairly open-ended. On the reverse side of the card are brief suggestions on how discussion groups may approach the various tracks.

Apart from a couple of epithets in one track, which are probably in character anyway, the conversation is relatively bland, leaving it up to the discussion group to evolve their own levels of frankness. (W.N.W.)

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The Graphic EQ Type d 10 is a new 2 x 10 band stereo graphic equaliser for professional sound reinforcement and studio applications. Its many applications include compensating for undesirable acoustic characteristics of a room or auditorium, anti-feedback, generating specific tone control responses or acting as an electronic crossover. The EQ Type D 10 features low noise centre — click sliders, a system by-pass switch and a rotary gain control. A front panel LED indicates when the equaliser circuits are in use.

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POWER OUTPUT (Both Channels Driven)	2 x 400 Watts, 2.5 ohms 2 x 300 Watts, 4 ohms	NOISE	— 100dB
		POWER BANDWIDTH	20 — 20 KHz, — 1dB
DISTORTION (8 ohms 1 KHz)	Less than 0.01%	SLEW RATE	10v/*us*
DAMPING FACTOR @ 8 ohms)	330	RISE TIME	3.5*us*

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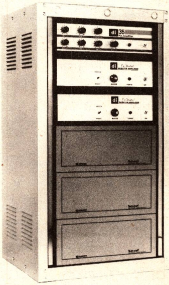

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AMATEUR RADIO

by Pierce Healy, VK2APQ

Expanded WIA education services assist prospective amateurs

One of the community services provided by the Wireless Institute of Australia is educational assistance for those interested in radio communication and/or electronics. In particular, it is provided for those who wish to qualify for one of the three grades of amateur licence available.

During the past 12 months this service, in which the young and the not so youthful participate, has assisted many to gain an amateur operator's licence. The rapid increase in the number of novice licenses issued by the P&T Department illustrates the point. There is no denying that the greater percentage of the successful candidates either attended classes or used technical publications available through WIA sources to assist them in their studies.

In addition, in an endeavour to offset examination jitters, pre-examination tests under exam room conditions were conducted in a large number of centres around Australia. Using techniques similar to those used by the P&T Dept (which WIA education officers assisted departmental officers to establish) it was possible to inform candidates within an hour how they would have fared had it been the real thing. This procedure allowed candidates to pinpoint their weak subjects and to brush up on these prior to the P&T Dept examination.

In NSW six radio weekends were conducted in country and near metropolitan centres. These weekends, at which accommodation and meals were provided at a very reasonable cost, were organised by members of the NSW WIA Education Service (YRS).

During 1979 there were 32 Youth Radio Scheme clubs registered in NSW, nearly all being in high schools and supervised by an amateur on the teaching staff. In addition, 18 radio clubs in city and country areas conducted classes using YRS material as a basic instruction syllabus.

At the time these notes were written, plans were being considered for an intensive radio study weekend to be held from January 25 to 28, 1980 in preparation for the February, 1980 P&T Dept AOCP examination. Information may be obtained from Ken James, VK2NWK, telephone (02) 638 1687 or Selwyn Carlyle, VK2NOK/YLJ, telephone (02) 31 9385.

A publication produced in 1979 by members of the NSW Education Service (YRS) was "500 Questions and Answers for the Amateur Operator Certificate of Proficiency". This book, based on the theory syllabus for the multi-choice type AOCP examination introduced by the P&T Dept for the August 1979 examination, is intended as a study guide. Its size makes it quite suitable to be carried in a pocket. It is also a valuable addition to any amateur's library. Price $2.50.

ABC-TV picked up in Austria

A transmission by ABC-TV Channel 0 in Wagga, NSW, has been picked up in Vienna by Austrian amateur Walter Ertelt, OE 1 WEB. The reception report, sent to the ABC through the Australian Embassy in Austria, reads as follows:

I received your TV transmission on Channel 0, Vision 46.25 and Sound 51.75MHz, today October 25, 1979 from 0820-0835GMT (1820-1835 Sydney time). Both vision and sound were received during this period, with vision only up to 0900GMT. Referring to the World Radio Handbook, I assume it was your transmitter in Wagga Wagga. The program contents: 0820GMT TV serial cast; 0830GMT announcement "ABC"; 0831GMT supposed western movie, started with a lot of shooting.

Vision quality was very poor to me, due to "plastic". I was unable to tune my set down to the low of 46MHz — European channels start on 48MHz. Signal strength was approx 20-30dB/uV, with unexpected long fading periods of approx 20s. This leads me to the assumption that no multi-hop F2 propagation was involved — it may have been a sort of "Super-Paddington-Ray". The antenna here is a simple vertical dipole.

I detected your signal while searching for DX signals in the six-metre amateur band. Enclosed is an audio cassette of the recorded sound channel, which has suffered from local electrical noise. Also enclosed is my amateur QSL card.

I hope you can confirm and I get your QSL for that event — such things happen only once in a lifetime. Distance is approx 16,000km. I well remember 1957 press headlines: "British TV received in Australia". If we consider the distance by frequency product, it may be a new world record for VHF propagation.

Yours sincerely,
Walter Ertelt, OE 1 WEB.

Although very noisy, the cassette recording was verified by the ABC as the end of "Anna and the King" and the start of "The Ghost and Mrs Muir: No. 1", broadcast 1830 local time in Wagga Wagga!

Another aid available is a Self Study Kit for the novice. This contains the Manual of Questions and Answers; 1000 Questions; Learning Morse Code (book and two C60 cassette tapes) and other material. Price $15.00 post paid.

There is also "50 Basic Electronic Projects" a booklet showing circuit details and description of each project. Price $1.50 post paid.

The Study Kit and project booklet are available from D. Wilson, PO Box 109, Toongabbie, NSW 2146. Cheques should be made out to WIA Education service.

From the Westlakes Radio Club, two very useful publications are available: "Manual of Questions and Answers for the Novice Licence", price $4.95 post paid; and "The Ham Exam Cram Book" for the AOCP examination, $3.00 post paid. Write to Westlakes Education, PO Box 1, Teralba, NSW 2284.

"Zero Beat" is the national quarterly news magazine of the WIA Youth Radio Scheme. The editor is Ken Hargreaves, VK2AKH, NSW YRS supervisor. Individual subscription rates are $3.00 per annum post paid. Clubs in NSW and Victoria receive "Z-B" as part of membership benefits on registration.

Subscriptions for "Z-B" may be forwarded to David Wilson, PO Box 109, Toongabbie, NSW 2145.

There are 17 clubs registered with the YRS in Victoria. One club worthy of mention is the St Paul's radio club at Traralgon which has 25 members studying for their novice licence and 13 studying for their full or limited licence. The club already has 14 novice and two limited licensees among the members.

The YRS supervisor in Victoria is Roy Hartkopf, VK3AOH, 34 Toolangi Road, Alphington, Vic 3078 who will be pleased to give full information regarding the YRS.

In NSW information may be obtained from Ken Hargreaves, VK2AKH, 52 Marlin Avenue, Floraville, NSW 2280.

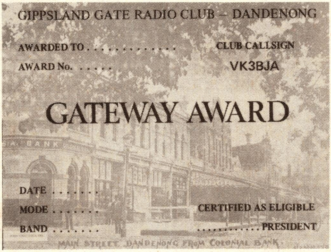
AWARDS

One of the many facets of amateur radio is the number of awards sponsored by national radio organisations or radio clubs throughout the world.

Here are details of the "Gateway Award" sponsored by the Gippsland Gate Radio Club, Dandenong, Victoria. The award certificate features a sepia toned photograph of Main Street, Dandenong in 1905.

To be eligible for the "Gateway Award" a total of 10 points must be gained. The points are assessed at the rate of one point for each contact made with a club member and two points for a contact with the club station VK3BJA. Contact may be made on any authorised band and mode.

Applicants should send details of log entries verified by two other amateurs together with $1.00 to the Awards Manager, PO Box 98, Dandenong, Vic 3175.



GIPPSLAND GATE RADIO CLUB — DANDENONG

AWARDED TO . . . . CLUB CALLSIGN

AWARD No. VK3BJA

GATEWAY AWARD

DATE . . . .

MODE . . . . CERTIFIED AS ELIGIBLE

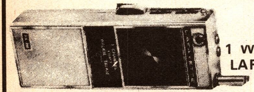
BAND . . . . PRESIDENT

MAIN STREET, DANDENONG FROM COLONIAL BANK

The certificate issued for The Gateway Award sponsored by the Gippsland Gate Radio Club.

Southern Cross Award: This award is granted to amateurs and short-wave listeners who gain the required number of points for working or hearing members of the Eastern and Mountain District Radio Club.

Lafayette)) TWO-WAY RADIO
FOR INDUSTRY, FARMS BOATS, SPORTS, ETC.



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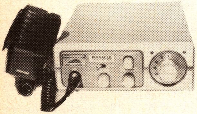

Pinnacle PE-920, 6 channels, 5 watts, transceiver for 27MHz marine, within premises and limited area services. Ideal mobile or base station unit. Design eliminates unwanted image interference from CB stations. Up-to-the-minute design with all wanted features.

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WOULD YOU LIKE TO JOIN THE RANKS OF AMATEUR RADIO ENTHUSIASTS?

The Institute conducts Course for the AOCP or LAOCP with the benefit of expert guidance throughout your studies.

PERSONAL CLASSES for 1980 will commence on Tuesday, February 5, 1980 at 6.00pm at Crows Nest and will continue for three terms to December in readiness for the February 1981 examinations.

CORRESPONDENCE COURSES may be commenced at any time.

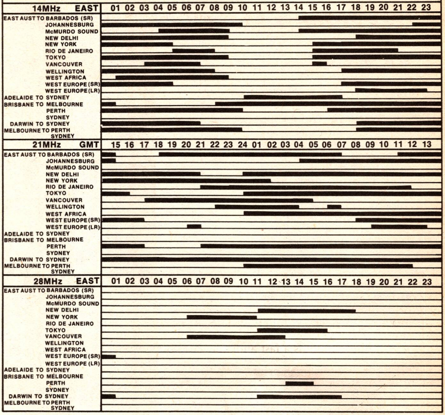
For further information, write to:

THE COURSE SUPERVISOR, W.I.A.
PO Box 123, St Leonards, NSW 2065

AMATEUR RADIO

IONOSPHERIC PREDICTIONS FOR JANUARY

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Department of Science. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. 1.80



To qualify, Australian amateurs and SWLs have to gain 15 points, New Zealand amateurs and SWLs 10 points, all other amateurs and SWLs 5 points. A point is awarded for each club member worked (heard for SWLs). The club station call signs VK3ER and VK3BNW each count 2 points but only 3 points can be claimed if both are included in any one application for the award.

To obtain the award a fee of 50 cents or 3 IRCs together with a general certificate log should be sent to the Awards Manager, EMDRC, PO Box 87, Mitcham, Victoria 3132. The general certificate log rule means that any officer of a recognised radio club or society, or any two licensed amateurs may certify that it is a copy of the applicant's log.

CENTRAL COAST FIELD DAY

Amateur radio operators, their families, friends, and all those interested in amateur radio are invited to the 23rd annual field day of the Central Coast Amateur Radio Club. The venue — Gosford Showground, Showground Road, Gosford, NSW. Date — February 17, 1980.

Events at the field day will include: HF and VHF scrambles; direction finding contests on 28.450MHz and 146MHz FM (mobile and hand-held equipment will be required); and hidden transmitter hunts on two metres AM for pedestrians, both junior and open events.

There will also be a ladies stall, children's events and afternoon outings to the Reptile Park and a cruise on the Brisbane Water.

Registrations commence at 8.00am: Men — $4, Women — $2; Children 16 years and under — $1. Pensioner concession is 50% on production of appropriate concession card. Registration fees includes morning and afternoon tea, subsidised outings and event entry.

The first event, a mobile scramble for those en route to the field day will be from 8.00am to 8.30am. There will be HF and VHF sections. Logs must be handed to the events recorder by 10.00am, showing time of each contact, station worked, mode, frequency, serial numbers in full and points claimed. Incomplete or late logs will not be eligible. Rules — no operation in showground or within 1km radius. VHF nets 1 point per contact; VHF tunable, CW, AM or SSB 4 points per contact. No operation within 0.5km of Gosford repeater.

All items for the disposal market must be in the Dwyer Pavilion before 9.30am. Catalogue forms and lot numbers must be obtained beforehand. Contact Bill Smith, VK2TS, RMB 4525 Gosford, 2250, or telephone (043) 74 1207 or at the Showground on Saturday afternoon, February 16.

There will also be trade displays of latest amateur equipment.

The field day will be held irrespective of weather conditions as there is plenty of shelter at the showground.

For an enjoyable weekend for the whole family why not book in at one of the motels or caravan parks in the area and participate in the field day activities. Or make a train trip on Sunday to avoid traffic problems. Trains arriving at Gosford at 9.20am from Newcastle and 8.45am and 10.09am from Sydney will be met and transport provided to the showground. Return transport to Gosford railway station will also be arranged.

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown 2200.

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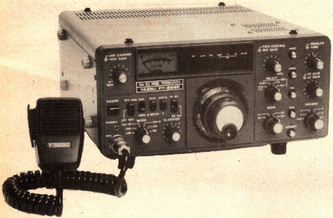
La Trobe University, Bundoora, Vic 3083.

YAESU F625RD ALL MODE SIX-METRE TRANSCEIVER

Six-metre enthusiasts who feel that their interests have been neglected by commercial manufacturers will be interested in the latest item from the Yaesu Musen factory. Designated FT625R and FT625RD, it is an all-mode, six-metre transceiver, with all the "mod cons" we have come to expect in modern amateur gear.

The FT625R and the FT625RD are basically similar, but the FT625RD has a digital readout system. The FT625R is the model currently available, and is the one reviewed here.

The FT625R is a continuously tunable (VFO) transceiver covering the six-metre band from 50MHz to 54MHz in four 1MHz steps. It features SSB (upper and lower sideband), CW, AM, and FM modes, repeater offset +/- 1MHz), VOX, clarifier, noise blanker, speech processor, continuously variable RF power output, plus other functions peculiar to individual modes.


The Yaesu F625RD. The dial is fitted with a skirt, behind the larger knob, which reads units and 10s of kHz, and a window, just above the skirt, which reads 100s of kHz

For the SSB mode there is a fast and slow AGC system, for CW a semi-break-in facility using a sidetone oscillator and the VOX circuit and for FM there is a squelch circuit and a discriminator position on the meter

The set is also designed to take several optional extras. One is the digital readout display, already mentioned; another is a memory unit which will store any selected frequency; a third is a narrow band (600Hz) CW filter. A switch position is provided for the latter. At the time of writing, only the CW filter is available ex-stock, but the other items may be imported, if justified by demand.

Other features include provision for up to five crystal controlled channels in addition to the VFO mode. The user can fit any crystals he prefers for popular channels and the necessary calculations are given in the manual.

There is also a 100kHz crystal oscillator, giving marker points every 100kHz, with provision to re-calibrate the dial, if necessary. A number of functions are brought out to the rear panel, such as the PTT circuit to permit foot-switch operation, the speaker circuit for external speaker connection and a socket for the Morse key. There is also a headphone terminal on the front panel. Power output is quoted as 25W for SSB, CW, and FM, and 8W for AM. Carrier suppression and unwanted sideband suppression are given as -40dB, or better, and spurious radiation as -60dB or better. FM deviation is set at +/-5kHz. Receiver sensitivity is given as 0.5uV at 20dB S/N for SSB and CW, 0.5uV at 10dB S/N for AM, and 0.35uV at 20dB S/N for FM.

The set may be operated from either 240V 50Hz AC mains (or other mains voltages as required) or 12V DC, as in a vehicle.

Tuning is by means of a two scale dial, driven by the popular Yaesu knob with finger recess for easy operation. One scale, called the skirt, is driven directly by the knob, and the other (the window) is via a reduction gearing. The MHz band is selected by the panel switch, 100kHz segments by the window, and tens and units of kHz by the skirt. Thus the frequency can be selected to within 1kHz.

The skirt is fastened to the knob by means of a friction fitting, which allows the skirt to be shifted to match the calibration markers from the 100kHz crystal.

So much for the general specifications; how well does it seem to meet these on the bench? For the most part, very well indeed. As with any VFO system, we were naturally anxious to see how accurately we could set the dial in anticipation of a known frequency signal. Selecting the popular 52.525MHz we were gratified to see that the first signal which appeared scarcely moved the discriminator pointer, and we repeated this exercise on several occasions.

Resolution of SSB signals was similarly gratifying. Perhaps the best thing that can be said about any SSB receiver is that it doesn't sound like an SSB receiver — and that certainly applies in this case. What is more, it appears to stay that way indefinitely after the first few minutes of warm-up.

The noise blanker is worthy of comment. While its effectiveness may vary according to the nature of the noise, it proved to be particularly effective against some quite vicious bouts of noise apparently consisting of high amplitude spikes to close together as to sound like a continuous roar. In fact, this blanker virtually wiped the noise, which was more than sufficient to drown all but the strongest signals.

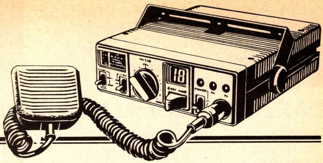
Reports from other amateurs were consistantly favourable for all modes. In one case, when using the AM mode, the value of the speech processing facility was effectively demonstrated by its ability to overcome a severe local noise problem.

Our main criticism of the unit concerns the audio response in the FM mode. It appears to have a more pronounced high frequency roll-off than found in most other units, or in the other modes of this same unit. While the SSB and AM modes produce crisp communication quality signals, the FM mode is noticeably deeper by comparison.

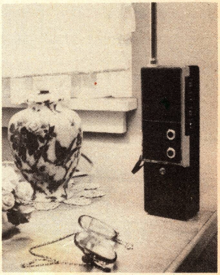
Apart from this, it appears to be an excellent unit in all respects, and we have no reason to question any of the maker's specifications. With the present high sunspot count and various forms of anomolous progation during the summer months, there should be plenty of opportunities for six-metre DX and the SSB mode, in particular, can take full advantage of these conditions.

The FT625R is priced at $795.00 which, considering what it offers, would seem to be very good value. Further details from Dick Smith Electronics, PO Box 747, Crows Nest, NSW 2065. (PGW).

The Australian
CB SCENE



A VERY PRIVATE USE FOR CB!



Don has one of those jobs which involves urgent telephone calls at odd hours during evenings and weekends. But, recently, his wife suffered a serious illness which made it impossible for her to go looking for him when he was wanted. That's where CB radio made all the difference.

Had Don and his wife lived in a villa or a home unit, there may not have been much of a problem. But they don't. They have a large home in one of Sydney's northern suburbs, built on a sandstone slope that runs steeply down into a gully. It's a pleasant spot, alive with bush birds, but there's always work to be done, while daylight lasts, to keep it under control.

And, under the rear of the house, Don has a workshop and a photographic darkroom, where he likes to "do his own thing" at other times.

Which is all very fine, provided whoever is in the house can let him know when he is wanted. But that situation came to an abrupt end when Don's wife fell sick, added to the fact that she sometimes needed help herself.

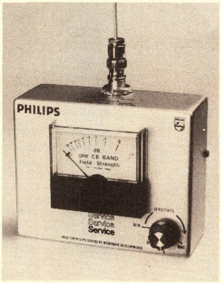
As it happened, Don has a technically minded friend who suggested that a couple of hand-held CB radio transceivers might solve the problem. They wouldn't cost the earth and, while they might have to put up with other transmissions on whatever channel they chose, at least they should be able to hear one another calling.

In short order, Don invested in a couple of 1W 3-channel hand-held Midland transceivers from Dick Smith Electronics at about $50 apiece and they met the need far better than he had dared hope. With the squelch turned well back, there was virtually no breakthrough of other, more distant signals and the two transceivers could be left turned on for lengthy periods in complete silence. However, there was never any doubt about their response to the signal from the companion transceiver, operating anywhere within the building or the allotment.

Don's wife is now well on the way to recovery but he regards the $100 as well spent. He can see plenty of other occasions when the transceivers will be useful, around the home and on holidays.

He makes the point that there must be plenty of other families in Australia where a similar problem exists. Maybe the people concerned have never thought of using low-power hand-held CB to keep in touch.

Field strength meter for UHF CB



Produced for Philips Service by Microwave Developments of Adelaide, the handy little field strength meter pictured above is intended for use by those involved in the servicing of UHF CB transceivers or by anyone else who needs merely to check their operation from time to time.

The unit is built into a brush-finished aluminium box measuring 130mm (w) x 102mm (h) x 52mm (d) and is self-contained, with two internal 9V transistor radio batteries. On the front is a meter calibrated from -10dB to +1dB, together with a combined off-on switch and sensitivity control. According to the specifications, normal battery life, with intermittent use, is about 150 hours, or up to 300 hours from long-life batteries.

The meter is intended to be used with the plug-in rod antenna, as supplied, and would normally be set up in the clear, about 20 metres from the antenna of a standard UHF CB transmitter. At this distance, a meter reading of 0dB would be expected, with the sensitivity fully advanced, equivalent to a field strength of -30dBm (1uW into 50 ohms). The meter is preset to cover the range 477MHz, +/- 5MHz.

The accompanying leaflet acknowledges that the readings will be relative, and sensitive to environment, body movements, etc, but they can still provide a useful indication of signal strength and some measure of antenna polarity pattern.

For further information: Philips Service Division, 443 Concord Rd, Rhodes, NSW 2138. Phone (02) 73 0231.

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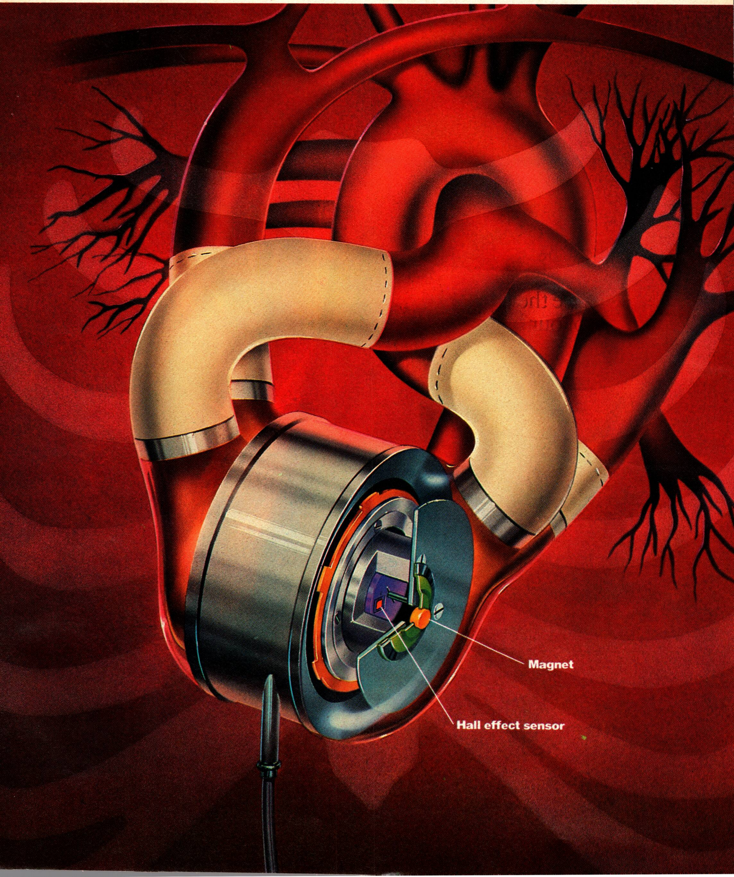

Until recently, the artificial heart was only a dream of modern medicine. A few medical pioneers at The Milton S. Hershey Medical Center of The Pennsylvania State University have made it a reality.

The first news came in 1977, when a mother of four underwent open heart surgery to replace a damaged heart valve. A heart/lung machine kept her alive during the operation. But after surgery, her heart failed, and specialists agreed she would die if removed from the machine.

Then they tried a small, experimental heart assist pump that today is controlled by our solid state Hall effect position sensor. It kept her alive for the eight days it took her to recover.

And yet, that pump is only part of what it takes to make a totally artificial heart.

Unlike the assist pump, the artificial heart is implanted inside the chest. So it has to be compact, and controllable. It must be made of materials that don't react with the body. And it has to beat without producing excessive heat.

Today the artificial heart is still experimental. But medical experts believe we have helped them solve one of their problems.

We gave them a heartbeat.

One of our Hall effect position sensors fit the requirements of Hershey's design. It controls the filling and emptying of plastic sacks that duplicate the natural motion of a healthy heart.

Already, a number of calves have been kept alive over 100 days. So far, one of our sensors has actuated over 18 million times in experiments at Hershey without a single failure.

And this is only the beginning.

Eventually, the artificial heart will be perfected for humans. Which means our sensor will operate about eighty times a minute. 115,000 times a day. 42 million times each year.

Working with customers early in their design process nearly always results in a better product. For them, and for us. That's one of the reasons why we have the widest variety of switches and sensors in the world. And, if we don't already have one that solves your problem, chances are we can design a solution together.

For information about how we can bring your project to life contact your local HONEYWELL Micro Switch Sales office located in your capital city. Or call (02) 699 0155.

Micro Switch products are available worldwide through Honeywell International.

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Can you afford anything less?

SHORTWAVE SCENE

by Arthur Cushen, MBE

WARC' 79: Shaping the future of shortwave broadcasting

The recent meeting of the World Administrative Radio Conference, held in Geneva, has made decisions which will influence shortwave broadcasting for the next 20 years. Some 1800 delegates from 148 nations attended the Conference.

The Conference has had the very important task of sharing out the radio frequencies for the next two decades and, naturally, the Third World countries were pressing for better allocation of the frequencies. Many are newcomers to short-wave broadcasting. There were some 11,000 proposals for new rules and frequency allocations before the Conference, and 1800 delegates from 148 nations worked in committees and working groups on these submissions.

According to a Radio Nederland report, there were 27 million pages of material before the Conference.

At the last Conference 20 years ago radio frequencies then were freely available. Today, more than 100 countries broadcast on short-wave and some 1500 short-wave transmitters are in use, compared with 300 in 1959. At the present time most of the frequencies are being used by two to three times the number of stations recommended by the International Telecommunications Union (ITU).

Today about 80% of the available short-wave frequencies are being used by only 10% of the nations of the world. This is one area where Third World countries called for a drastic change to allow the development of their own communications facilities.

One of the early reports from the Conference indicated that the developing countries are to receive technical advice and help from leaders in the international broadcasting field. This will enable them to exploit their newly allocated frequencies using modern technology.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add eight hous for WAST, 10 hours for EAST and 12 hours for NZT. In areas observing Daylight Saving Time add a further hour.

FINLAND'S NEW SERVICES

Radio Finland is broadcasting a transmission in English to North America which is heard in this area during our afternoons. The program is on 9645 and 11755kHz, and includes news and other regular features heard from Helsinki.

"Radio Finland" is again being used as the slogan following a brief period during which "Finnish International Radio" was the station identification announcement. Radio Finland is also received in its transmission to Australia 0930-1000GMT on 21465kHz daily and on Sunday the Sunday Best program is broadcast 0800-0930GMT. Radio Finland advises that it has a new address: Radio Finland, Box 10, 0021 Helsinki 24, Finland.

NEW INDIAN FREQUENCY

All India Radio, Delhi, broadcasts two transmissions to Australia and New Zealand. The first, for morning reception 2045-2230GMT, is now using 15110 and 11755kHz. The evening broadcast 1000-1100GMT is on 15205 and 17875kHz.

All India Radio provides excellent reception on both of these frequencies. The program is varied and includes news commentary, interviews and Indian and western music. The All India Radio frequencies used to the United Kingdom at 2045GMT are 11620 and 15165kHz.

ARMED FORCES RADIO

The American Armed Forces Radio and Television Service provides 24 hours of spoken entertainment and information for listeners throughout the world. Since the closing of the Dixon transmitters in California, programs to the Far East are carried from Delano in California or the Philippines relay base.

The transmissions originating from Delano include 9700kHz 0900-1600GMT; 11805kHz 0900-1100; 15330kHz 0430-0700; 17765kHz 0200-0700 and 1600-2200; 21570kHz 1800-0430; and 25615kHz 2200-0200GMT.

Transmissions from the Philippines are on 11835kHz 1900-0100GMT and 21670kHz 0100-1900GMT. Broadcasts from the Greenville and Bethany transmitters on the east coast of North America provide a service to Central America, Europe and Africa. The address for reception reports is: Armed Forces Radio and Television Service, Washington, Room 301, 1117 North 19th Street, Arlington, Virginia 22209, USA.

AUSTRIAN SCHEDULE

Broadcasts from the Austrian Radio at Vienna are beamed to this area from 0400-1300GMT daily. The transmission is cut up into several short periods, and is carried mainly on the 13 metre band. The present schedule is: 0400-0600GMT 17745kHz; 0600-0700 21500kHz; 0600-0900 21640kHz; 0700-0900 21735kHz; 0900-1100 21585kHz; and 1100-1300 21725kHz. English is broadcast 0830-0900GMT daily and on Sunday at 0900GMT there is the special 15 minute session for short-wave listeners — Austrian Short-wave Panorama.

EXPANDED LANGUAGE SERVICE

Radio Nederland, according to its Annual Report, is thinking of expanding its existing foreign-language broadcasts, despite the organisation's somewhat difficult financial situation. The station currently broadcasts in Arabic, English, French, Indonesian, Portuguese, Spanish, Papiamento and Sranan Tongo (Surinamese). There are now plans for regular broadcasts in Chinese, Japanese and Russian to improve the station's competitive position.

SHORTWAVE SCENE

Radio Nederland at present broadcasts to Australia in Dutch 0630-0725GMT on 9630 and 9715kHz and 0830-0925GMT on 9770kHz. English is broadcast to this area 0730-0825GMT on 9715 and 9770kHz, and 0830-0925GMT on 9715kHz.

FREQUENCY CHANGES

CANADA: Radio Canada, Montreal, is using the new frequency of 11770kHz for its transmission in English to North America. This transmission also provides secondary coverage to the South Pacific. Broadcasts are 0300-0327 and 0400-0427GMT and 11845kHz carries the same program. The other channels, 9535 and 5960kHz, are too low for reception during our summer.

ECUADOR: HCJB in Quito is continuing to use the same frequencies for its gospel programs to Australia and New Zealand. Broadcasts are 0600-1200GMT on 6130 and 11900kHz, and 0700-1030GMT on 9745kHz. There have been changes for the English program to Europe. This is now heard 0700-0830GMT on 9760 and 11835kHz; and 1900-2000 and 2130-2200GMT on 15295, 17890 and 21480kHz.

NORWAY: Oslo broadcasts to the South Pacific in several transmissions but the two which are best received are carried at 0700-0830 and 1100-1230GMT. The first transmission is on 9590, 11850 and 21730kHz; the second on 15345 and 21730kHz. English is broadcast on Sundays for the last 30 minutes of the program.

PAKISTAN: Radio Pakistan is using the new frequency of 21635kHz in transmissions beamed to East Africa. The frequency is in use up to 1745GMT with a program in Swahili with a five minute news bulletin in English at 1740GMT. The frequency is in use from 1230GMT in the Bangla Service to Asia and continues in other Asian languages before its broadcast to East Africa. The same program is carried on 17660kHz.

SOUTH AFRICA: Radio South Africa is using the frequency of 21695kHz for a broadcast in French 1800-1850GMT. In the past, this frequency has been blocked by Radio Canada but the broadcast from Montreal now ceases at 800GMT leaving the frequency clear for the broadcast from Johannesburg.

SPAIN: Madrid has been noted on the new frequency of 15405kHz at 0730GMT for its broadcasts in Spanish to Australia and the Philippines. The same program is available on 9520 and 11730kHz and though it is supposed to open at 0730GMT transmissions have been noted earlier. The new channel of 15405kHz gives much better reception in this area.

Madrid has also been heard on 17890kHz, a new channel, with broadcasts in Arabic. Transmission time is from 1800 to close-down at 2030GMT when the station leaves the air after full identification in Arabic. Most of the program consists of Arabic talk, but there is some Spanish music throughout the transmission. This frequency is later used by Radio Australia, HCJB in Quito and also Taipeh, Taiwan, but during the period when Madrid is using 17890kHz the channel is clear and gives a very strong signal in the South Pacific.

SWITZERLAND: Swiss Radio International, using 21630kHz with English 1100-1130GMT, continues to provide good reception. A French broadcast is heard at 1130 on the same frequency.

LISTENING BRIEFS
EUROPE

CZECHOSLOVAKIA: Radio Prague broadcasts to Australia and New Zealand in English daily 0730-0800GMT on 11855, 17840 and 21700kHz. The broadcast is repeated 0830-0900GMT on the same frequencies. On Saturday and Sunday there is a special transmission 0900-0930GMT, again on the same frequencies. This schedule from Prague is valid up to May 4, 1980.

GREAT BRITAIN: The BBC has announced that four transmitters of 250kW are being installed at Woofferton and will be used mainly by the Voice of America for transmissions to Europe. The BBC World Service broadcast to Australia during the present transmission period has made only one major frequency change with 7120kHz operating 1800-2030GMT and replacing 21710.

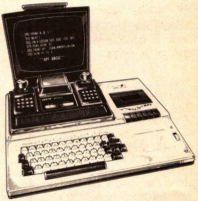
PORTUGAL: Lisbon has been heard on the new frequency of 11925kHz on its transmission to North America. This frequency carries English at 0300 and 0500GMT for 30 minutes.

GREECE: Athens has been noted on 7205kHz 2100-2150GMT with Greek to Australia. The same transmission is also carried on 9640 and 9760kHz. The transmission from 0900-0950GMT is on 9655 and 9760kHz.

MALTA: The well-known Portugese base Radio Renascenca, the Catholic gospel station, is now using the Cyclops transmitter in Malta to broadcast programs in Portugese to Europe. According to the BBC Monitoring Service, the transmission is on the air 1500-1530GMT on 9670kHz daily. The Malta transmitter has also been used by the Swedish gospel organisation IBRA Radio, with a transmission opening at 0600GMT on 9625kHz on Saturdays

SWEDEN: Radio Sweden, Stockholm, broadcasts to Australia in English daily 1100-1130GMT on 21690kHz. The program includes news and, on Tuesdays, "Sweden Calling DXers". The single sideband transmission of the Swedish Home program continues to be heard on 21550kHz from 0630-0800GMT.

APF
The Imagination Machine



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New Products

Texas Instruments Programmer Calculator

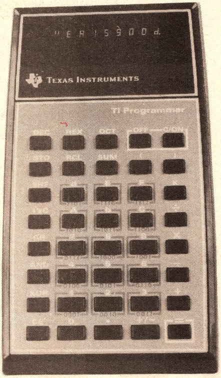
A new calculator recently released by Texas Instruments should interest microcomputer hobbyists, computing students and even professional programmers. Designated the TI Programmer, it performs the four standard math functions in either decimal, octal or hexadecimal, plus conversion from one base to another as well as logical functions such as XOR, AND, OR, and shift.

The TI Programmer is housed in a standard TI plastic calculator case and comes with a set of instructions, carrying pouch and AC adapter. The display consists of eight seven-segment LED displays plus a sign, overflow and base indication. Electronic on/off control is also provided, as it is on most TI calculators. The calculator is turned off or on by front panel keys rather than a slide switch, and power is also turned off automatically to conserve battery power if the calculator is accidentally left on.

The keyboard uses small black plastic keys that provide a positive tactile impression when a key stroke is made. There are 16 numerical keys, 0 to 9 plus A to F for hexadecimal numbers and 10 function keys, viz logical shift, 1'sC (one's complement), OR, AND, XOR, +, -, x, /, and +/- (two's complement or sign inversion in decimal mode). Also included are three keys for setting the number base, viz decimal, octal or hexadecimal, and memory store and recall keys, parentheses and a constant key. Key layout is good and the numeric keys are also clearly identified and include binary notation to simplify handling of binary numbers.

Decimal calculations can be made in floating point but when the results are converted to hex or octal, which are both treated as integers, the results are truncated. Hex and octal calculations are done in two's complement, as is usually the case with large computers and certainly all microcomputers. Logic operations are bit-wise and of course they only work in octal and hex. The shift operation is what is termed a logical shift rather than a rotate or an arithmetic shift, and while the logical shift is quite useful it would have been desirable to also have the other two functions plus a word-bit length specification.

Considering its features the TI Programmer is aptly named; in fact for assembly language and machine language programming it is just about essential. Offset addresses for relative jump calculations are easily made by either counting up the jump distance and then converting from decimal to hex or octal, or simply subtracting the two hex or octal addresses directly if a listing is available. Mixed base calculations are also easy since all numbers either displayed or in memory are automatically changed when the base is changed, so absolute addresses can be calculated by adding jump distance in decimal to starting address in hex with a result in any base you like.

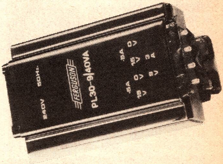


The base conversion functions are also useful for assemblers or even compilers such as Basic that don't allow hex or octal base constants. If more complex constants such as bit masks are desired then it is a simple procedure to convert the bit mask to a decimal constant via the binary notation on the numeric keys and use of the hexadecimal to decimal conversion function.

As far as programming is concerned it is clearly a time saver, but its usefulness also extends to debugging operations. Using the various logical and mathematical operations it is possible to step through a program checking results with the Programmer as you go, and that is certainly easier than performing countless "XORs", "rotates" and "two's complements" by hand.

Our review sample came from Delta Scientific Product Distribution, Red Bank Court, St Albans, Victoria 3021. Their price on the TI Programmer is $69.95, which includes batteries, charger and sales tax. The TI Programmer can be obtained from all retail outlets for Texas Instruments calculators. (R. de J.)

40VA Transformer for Microprocessor Circuits



Ferguson Transformers Pty Ltd have produced a version of their flatpack 40VA line for microprocessor circuits. The PL30-9/40VA has a 9V 3-amp winding and two 15V 0.5-amp windings and conforms to ASC 126.

FM Wireless Intercom from Dick Smith

A new product recently released by the Dick Smith Electronics Group is a two-channel FM wireless intercom system. It is mains operated and uses the mains wiring as the signal path thereby obviating the need for wiring between the units.

The units are housed in black plastic cases measuring 222 x 140 x 45mm and are finished off with an attractive brushed aluminium panel.

There are six controls, two of which are of the set-and-forget type, these being the call-tone selector and the channel selector. The other controls are the power/volume control knob, the call button, the push-to-talk key and a lock-down key. The lock-down key is particularly handy if the intercom is to be used for say, monitoring the baby's room, or any application requiring hands-free operation.

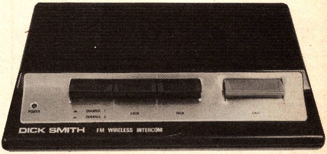
Operation of the units is a simple matter only requiring the unit to be plugged into the mains. If the building or home wiring uses more than one mains-phase, the user should ensure that the intercoms are both plugged into the same phase for satisfactory operation and performance.

The units are based on a phase-locked loop which is used to generate and modulate the carrier. The carrier frequencies are 200kHz for channel-1 and 250kHz for channel-2. The incoming signal to the unit is detected and demodulated by the phase-locked loop and then fed to an audio amplifier and speaker.

In normal use around the home the units perform well with very little interference. While the units are idling, they are very quiet indeed. If the units are to be used in an electrically noisy environment, for example a factory with a lot of machinery, it will be found that the performance deteriorates due to interference on the mains.

If you are considering the purchase of an intercom system, it may be well worth your while to take a look at these as they represent good value for money, particularly if their versatility and the convenience of no additional wiring is taken into account.

Recommended retail price of the FM Wireless Intercom is $49.50 for a pair. They are available from all branches of Dick Smith Electronics and Dick Smith dealers. (G.C.)



A pair of these intercoms can be installed without any additional wiring: just plug into the mains.

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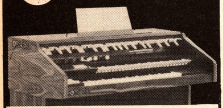

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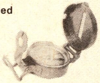

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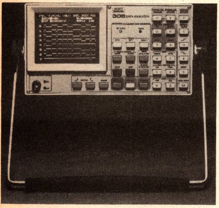
SORRY NO C O D

Sony/Tektronix 308 Data Analyser



The Sony/Tektronix 308 Data Analyser is the first instrument to combine the capabilities of a state and timing logic analyser, serial data analyser and signature analyser into one compact instrument. The unit is intended for applications in computer and computer peripheral manufacturing and troubleshooting, industrial process control, telecommunications, electronic test and measurement, and a variety of government applications.

The colour-coded keyboard controls, and the support documentation, including manuals and video tapes, allow the user to quickly master digital troubleshooting techniques and serial data and signature analysis.

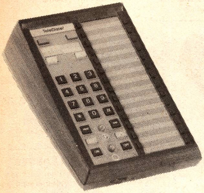
The parallel timing analyser provides eight channels at 20MHz with 256 bits/channel memory size. The eight-channel parallel word recogniser provides internal triggering upon recognition of preset digital-system state. This capability is expandable to 24 channels with the optional P6406 Word Recogniser Probe.

A memory window provides magnification for viewing timing displays. Digital delay counts up to 65,536 clocks and data can be stored at sample intervals of 50ns to 200ms. The stored data is displayed on the self-contained 10cm television type CRT screen in timing format.

The serial state analyser acquires 5, 6, 7 or 8 bits/character data synchronously or asynchronously. Two character word recognition provides internal triggering upon recognition of present digital-system state. Digital delay counts up to 65,536 words and data can be stored at rates of 50 baud to 9600 baud for display on the CRT screen in binary, hex and ASCII format.

Further information from Tektronix Australia Pty Ltd, 80 Waterloo Rd, North Ryde, NSW 2113.

STC Teledialer 32



Designed in America, the Teledialer 32 is an automatic telephone dialling unit that stores frequently used numbers in a solid state electronic memory.

Numbers can be deleted and new ones programmed into the unit at will. Up to 16 digits can be logged for a single listing by activating the memory "on" button and the button next to the name to be replaced. The digits are then entered by way of the standard pushbutton keypad.

Up to 32 numbers can be programmed into Teledialer. To make a call, the user simply presses a button next to the word listing, and the unit goes into the action — doing the work of a secretary or telephonist. There's no need to lift the telephone receiver until the call is answered.

A touch of another button will disconnect the call should the number be engaged.

The last number dialled is committed to memory and can be recalled by pushing the "32" button. Reconnection is automatic. This feature is a real timesaver when a call is met by an engaged signal.

An in-built speaker makes it possible for the conversation to be shared with others in the room. The moment the call is answered, this speaker — which lets the user hear the phone ring — shuts off automatically unless the "speaker on" button has been pressed.

The Teledialer fully conforms to Telecom Australia standards as a permitted attachment.

Enquiries to Standard Telephones & Cables Pty Ltd, 252 Botany Rd, Alexandria, NSW 2015.

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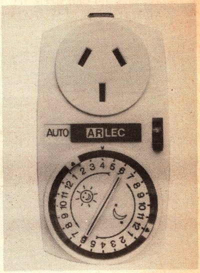
For further information please write to:

The Admissions Officer,
Australian Maritime College,
PO Box 986,
Launceston. Tas 7250

Automatic time switch



Recently introduced by A&R Electronics Pty Ltd, the Arlec "Superswitch" is a lightweight time switch for automatic control of a wide variety of electrical appliances.

Superswitch can be used to control an electric blanket during the winter months or a swimming pool filter pump during the summer. In between times it can be used to discourage burglars by switching house lights and radios on and off while the occupants are away, or to set heaters/air-conditioners going in advance to ensure a comfortable home on their return. It can be set to control cooking times for electric frypans, crockpots, grills, etc, or can be used to automatically switch on your TV set in time for the evening news. It can even have your coffee ready when you get up in the morning.

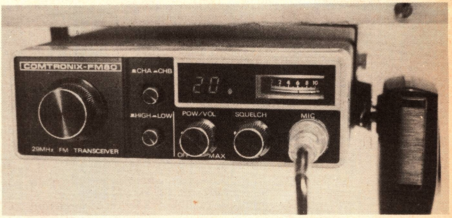
Superswitch is simple to set and operate. Quick set actuators on the timing dial allow a wide variety of time intervals to be selected. The number of actuators used may be increased or reduced according to the number of on-off cycles required during the 24-hour period.

Programs can be set to repeat daily or can be deferred by selecting manual instead of automatic operation. An additional on/off switch allows the appliance connected to the timer to be switched on or off at will, irrespective of the time settings.

Superswitch is powered by a quiet-running synchronous clock-motor which starts as soon as the unit is plugged into the mains. A neon indicator lamp in the unit housing glows when the timer is switched to the on position.

Further information is available from the manufacturers: A&R Electronics Pty Ltd, 30 Lexton Rd, Box Hill, Victoria 3128.

80-channel FM transceiver



GFS Electronic Imports has announced the release in Australia of a new 80-channel FM transceiver, the Comtronix FM-80.

The FM-80 is a fully synthesized transceiver that runs 10-15 watts output over the frequency range 28.91 to 29.7MHz (it can also be made to operate 28.01 to 28.80MHz) in 10kHz steps. FM deviation is ±3kHz.

Channel number is indicated by a bright LED readout. Other features include "Hi-Lo" power switch to reduce transmitting power to 1W for local conversations, adjustable squelch for muted standby operation, and an illuminated meter reading "S" units and transmitter power.

Recommended retail price of the FM-80 is $289. For further information, contact GFS Electronic Imports, 15 McKeon Rd, Mitcham, Victoria 3132.

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650B	2.60	650A	4.00	138	3.80
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590B	8.00	590A	8.00	78MC10	4.00
78E09	2.50	ET605	7.00	ET391B	2.50
ET391A	2.50	ET551	3.00	ET641	ON/AP
ET591C	2.20	ET550	2.80	ET592	4.50
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78TSC7	2.50	78PT7	2.50	78VBG7	3.50
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ET450A	2.80	ET716	4.00	ET715	3.00
ET486	3.20	ET245	2.50	78C2	3.00
78AF2	3.00	78S3	2.60	78CF1	2.80
77CB12	2.60	77PH12	2.60	77PM12	3.50
ET135	3.00	ET586	2.80	77MX11	2.50
775C11	3.80	77PS11	2.50	77UP6A	3.00
77MX11	2.50			77PS11	2.50
ET604	2.50	ET585T/R	3.00	ET635	2.80
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ET485	2.80	ET484	3.00	ET581	2.50
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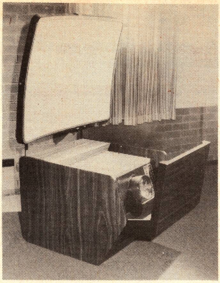
Large-screen projection TV system



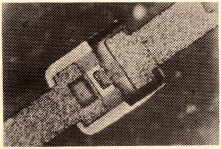
R.B. Davies Industries Ltd, traditionally a manufacturer of building hardware, has entered the electronics field with a one-piece large-screen projection TV system — the Superscreen V-6000.

Superscreen V-6000 is a single lens system employing a 127cm diagonal screen, said to provide sufficient brightness for viewing in normal lighting conditions. The colour tube and electronics are supplied by Rank Arena, a factor which should ensure an adequate supply of spare parts.

The unit comes complete with a remote control and a 12-month warranty. Price is around the $2,500 mark.

Further information from R.B. Davies Electronics, 40 Robbs Rd, West Footscray, Victoria 3012 (phone 314 0711). Also at 19 The Strand, Penshurst, NSW 2222 (phone 510 4333).

Low-noise GaAs FET from HP



A new low-noise Schottky gate GaAs FET, the HFET-2202, ideally suited for such applications as land and satellite communications and radar, has been introduced by Hewlett-Packard.

This new transistor packages HP's 0.5 x 250um gate GaAs FET chip in a 2.5mm square hermetic metal/ceramic stripline package to achieve excellent noise and gain performance in the 2 to 12GHz frequency range. Typical noise figure values at the high usage frequencies of 4, 6 and 8GHz are 1.1, 1.4 and 1.9dB respectively, with associated gains of 13.6, 11.3 and 9.6dB.

The HFET-2202 is an economical FET that can handle many lower frequency narrow-band applications. It should be especially well suited to the 3.7 to 4.2GHz telecommunications region.

The HFET-2202 is available from HP's franchised distributors, Cema Electronics Pty Ltd, 21 Chandos St, St Leonards, NSW 2065.

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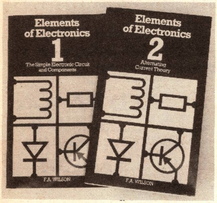
Books & Literature

For the beginner . . .


Elements of Electronics
1
The Simple Electronic Circuit and Components
F.A. WILSON
Elements of Electronics
2
Alternating Current Theory
F.A. WILSON

ELEMENTS OF ELECTRONICS 1, by F. A. Wilson. Stiff paper covers, 209 pages, 183mm x 108mm, illustrated by circuits and diagrams. Published by Bernard Babini (Publishing) Ltd, London. Price in Australia $6.75.

ELEMENTS OF ELECTRONICS 2, by the same author, publisher. Same price. 216 pages.

In the past, Babini publications have tended to be unpretentious and inexpensive. These two are still in the paperback format but they are larger than usual and carefully organised in respect to content. Without knowing the Author's background, I would judge him to be a professional educationalist, who tends to write for students rather than the casual reader.

Whereas many small books, which set out to present electronic fundamentals, rely on mental imagery, F. A. Wilson deliberately resorts to basic mathematical expressions, which increase in complexity as the discussion itself progresses.

Book 1 is subtitled "The Simple Electronic Circuit and Components". It begins with the nature of electricity, then moves to sources, simple circuits, resistors and batteries. There is a section on electrostatics: capacitors and capacitance. Another covers electromagnetism: induction, inductors, magnetism etc. Appendices cover abbreviations, decimals, logarithms, maths revision, geometry, units, symbols, and other such items.

Book 2, subtitled "Alternating Current Theory" carries right on and, as you would expect, involves heavier going. It deals with waveforms and waveform terminology, sine waves and complex waves. There is a chapter on time constants and another on AC circuits, covering impedance, power and Q, series and parallel complex circuits. Resonance is covered and, of course, transformers. Appendices deal with graphs, trigonometry, vectors, epsilon, rate of change, infinity etc.

As will be apparent from the above, the books give all the appearance of having been designed for use by students and we would not be at all surprised to see them taken up in Australia for that purpose. In the meantime, they could be read to advantage by anyone who wants to undertake revision or to set their ideas in order.

Book 3 in the series will cover solid-state devices. Our advance copies of Books 1 and 2 came from Technical Book and Magazine Co Pty Ltd, 289-299 Swanston St, Melbourne 3000. (W.N.W.)

Optoelectronics Manual

OPTOELECTRONICS MANUAL, GENERAL ELECTRIC. Semi-conductor Products Department, Syracuse. New York, 1976. Paperback, 188 pages, 273 x 213mm, many diagrams. Price $3.45.

This optoelectronics manual follows on from General Electric's other successful manuals, such as their SCR manual. It has six basic sections followed by an appendix containing data for a large range of optoelectronic components. The data occupies about half the volume of the book and is quite comprehensive, dealing with the complete characteristics of IREDs, optocouplers and LASCRs etc.

The first section explains the basic operation and characteristics of the various optoelectronic devices. The mathematics is straightforward but it still manages to explain such phenomenon as gain vs response tradeoff in phototransistors and the constant current characteristics of photodiodes. The section concludes with how the basic devices are used together in optocouplers and interrupter units.

Section 2 is the only other major section and it discusses the features of complete systems such as spectral response of the various opto transmitters and receivers, lens systems, input/output and isolation characteristics of optocouplers and the characteristics of photodarlingtons. The remaining sections in order are Reliability, Measurement of parameters, Optoelectronic circuits and finally a Glossary of terms.

Altogether the manual is well written in an easy to understand language that should appeal to beginners and hobbyists alike. Apart from the text the other sections such as the glossary of terms, the large section on optoelectronic circuits and the data section should prove invaluable in themselves. (R. de J.)

Amateur Radio

RADIO AMATEURS' EXAMINATION MANUAL, by G.L. Benbow. Radio Society of Great Britain, 8th edition, 1979. Soft covers, 180 x 245mm, 114pp, many diagrams. Price in UK, £1.85.

While produced primarily for the British amateur radio scene, this book would still be useful reading for any prospective Australian amateur. The material on things like licence conditions would be of only general interest, but the technical chapters are packed with valuable reference material.

And the word "packed" in the previous paragraph was chosen deliberately; the overall impression is one of almost ruthless condensation. This is not a criticism; on the contrary I believe the approach adopted should allow the student to be made aware of basic concepts and to acquire at least an elementary grasp of them. He is then in good position to expand his knowledge as and how he desires.

The chapter on electrical theory and calculations is particularly impressive. Covering 20 pages, it starts with atoms and electrons and progresses through electrical units, DC circuits, Ohm's law, AC circuits, magnetism, inductance and capacitance, resonance, piezo-electric crystals, decibels etc, together with all the basic formulae which these subjects involve. These latter, alone, constitute a very useful reference source.

The remaining chapters deal with semiconductors, receivers, transmitters, power supplies, antennas, interference, measurements, and radio circuit symbols on the technical side. Other chapters cover licence conditions, operating practices, tackling the exam, examination syllabus, and practice multiple choice questions. These latter chapters can be valuable provided the local requirements are kept firmly in mind.

A notable omission is any chapter on hermionic devices, which is perhaps a ign of the times. However, some valve ircuits have been used as examples in he section on test equipment.

We noticed a few minor ypographical errors, such as a missing ninus sign on page 6. There is also a ather unfortunate statement on page 5, which could be taken to imply that M deviation is directly related to the udio bandwidth of the modulating ignal.

These minor points aside, this is a ery comprehensive and well produced ook, and commendably inexpensive. t would be a valuable addition to any rospective candidate's study material.

Our copy came direct from the ublishers, but it should be available hrough local bookstalls. (PGW)

omputer Revolution

HE MICROCOMPUTER REVOLUTION, by William J. Caelli. Published by the Australian Computer Society Inc., 1979. Soft covers, 147 x 206mm, 185pp, with illustrations. Price $10.

Dr Bill Caelli is well known in the ustralian computer industry. He has orked in both the hardware and oftware areas for more than 15 years, nd has been a driving force in the ustralian Computer Society. Apart rom his wealth of experience and deep nsight into computing he also stands ut among conventional computer eople as one with that rare ability to ecognise significant developments in echnology, and the imagination and oresight to see their implications.

These qualities make him not only a ascinating person to talk with, but also n ideal person to write this nonograph assessing the present and uture implications of the microcom- uter revolution.

An updated and rearranged version f an earlier report produced for the CS in 1977, the new work is probably s current, as cohesive, as comprehen- ive and as reliable an evaluation of the nicrocomputer phenomenon as you re likely to find anywhere — here or verseas. For the thoughtful reader vith even a smattering of interest in echnology, it should be fascinating eading.

In fact, the subject is so important nd this monograph so timely and hought-provoking that it should lmost be made compulsory reading or all educators, politicians and usinessmen — not forgetting com- uter people as well.

Copies of the monograph are vailable for $10 (including handling nd postage) from the Australian Com- uter Society Inc., PO Box 640, Crows Nest, NSW 2065. (J.R.)

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IC Converter Cookbook (Jung)	$18.95
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INFORMATION CENTRE

MORE CDI PROBLEMS: I read with interest the letter of SW concerning the Capacitor Discharge Ignition and the associated reply in the Information Centre section of Electronics Australia, October 1979. The complaint was that the CDI unit cuts out. However the reasons given for this in the reply are incorrect as it is not the SCR which is causing the failure of the unit. I have constructed and used a Dick Smith's CDI Kit, K3280 which uses the Electronics Australia circuit. I found that although the output voltage was correct for the associated input voltage, the unit occasionally cut out when installed in my car. This failure as stated by SW is intermittent and can occur within a few minutes of starting the vehicle or not occur in several weeks of daily use. For this reason it is most unlikely to be observed when bench testing. My investigation into the cause has shown it to be a design weakness!

The problem is that the oscillator circuit is influenced by the characteristics of the 2N3055 transistors. When the unit fails it is in fact operating in a high frequency mode (20kHz) which is outside the audio range and the characteristic whistle is therefore not heard. As a result, most of the power is dissipated in the transistors during the switching cycle and insufficient energy is available to charge the output capacitors and subsequently fire the SCR. I have verified the above claims by using a pair of 2N3055 transistors of a different manufacturer to those supplied with the kit. The replacement pair of transistors resulted in the unit failing to a much greater extent although laboratory testing experience had previously shown that these transistors had better switching temperature characteristics and could have been expected to perform better.

To check if the above mode of failure occurs while installed in the vehicle the following steps should be observed:

1. When the vehicle loses power (due to loss of ignition) assume the unit has failed (cut out) and leave the ignition switched ON.
2. Listen for the characteristic whistle — this should be absent and either no sound or a very high frequency tone emitted.
3. The power transistors should be found to be quite warm (when correctly operating they are cool).

If the ignition switch is turned off and then back on this normally stops the high frequency oscillation and the fault will not be detected.

It is my opinion that the high frequency oscillation is due to the transformer/transistors behaving as a tuned circuit. Hence a simple solution is to place 0.1uF capacitors across the base-collector junction of each transistor, effectively de-tuning the circuit. I have done this with a remarkable improvement in the performance of the CDI system. (J.H., Tea Tree Gully, SA).

● We do not agree with your solution to the problem although it may have worked. Slowing down the switching action of the transistors increases the dissipation during the switching transition and may render starting of the inverter unreliable.

The high frequency oscillation is not a characteristic of the CDI design. Its occurence suggests that the core material is not correct or the interwinding capacitance is higher than it should be. Is the bifilar winding technique being used?

DISSOLVER: On reviewing my copies of your magazine, I came across a correspondent's query in the June 1976 issue on page 123, under the heading "Audio Visuals". The correspondent requested a control unit to fade the lamp of one automatic slide projector while the second projector is brought up to full brightness. I, too, and many of my acquaintances are also anxious to construct such a system. (R.B., Wembley, WA).

● Since yours is only the second letter since June 1976 requesting such a control unit, we have not given any thought to the project. The electronics would be fairly simple, consisting mainly of a pair of ganged light dimmers. The Triacs would require snubber networks where they are used with projectors having transformers and it would be necessary to isolate the lamp circuit from the motor circuit, in each projector.

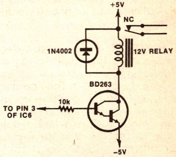
Unless we have further correspondents evincing interest in this idea, we are unlikely to go ahead with such an article, though. Not too many readers have access to two automatic slide projectors.

UPGRADING LOUDSPEAKERS: Back in the sixties I made a set of bookshelf speakers from one of your magazines. They have served me well since then but I would now like to convert them to better quality 8-ohm speakers with a suitable crossover network. The speakers just removed are a Magnavox 6WR and Rola 5FX tweeter together with the crossover network then

---

REMOTE CONTROL: I am writing for some information regarding the "Stereo Infra-red Remote Control" unit that was in the October 1979 edition of your magazine. I would like to know if it is possible to use this unit as an "on-off" switch, as well as a volume control? If so, would you please send me details and a diagram on how this would be done. It is to be used in conjunction with the "Playmaster Twin-Ten amplifier". (G.H., New Lambton, NSW 2305).

● The simplest way of using the remote control unit to switch mains equipment on and off, as well as controlling the volume level, is to use the lowest position on the volume control. When the volume is switched down to the lowest level a relay switches mains power off and if the up button is subsequently pressed the level will skip up one and the relay turns power on again.



The circuit is shown in an accompanying diagram and it uses only a few components which could be mounted on a small piece of Veroboard in a separate box along with as many mains sockets as are required. Take the normal precautions when wiring the mains and use a relay with the appropriate contact rating.

uggested by your magazine. Would ou suggest alternative speakers of igher power rating that I could urchase somewhere? (J.G., Mt Gravatt, Qld)

● The process of designing oudspeaker systems has become coniderably more refined than it was in he sixties. It is not just a matter of electing a few speakers and deciding vhat size box to put them in. Comromises must be made between low requency rolloff, power handling and efficiency. So there is no simple answer o your request. Why not build the compact loudspeaker system described n our December '79 issue.

ARIABLE DELAY WIPER: I was thinkng of making this unit (May 1975, /AU/12) but found trouble deciphering the switch assembly. Could you tell me where to obtain the switches and he PCB, 75w3? (B.J., Merbein, Vic).

● It is likely that you will find it difficult to obtain these switches. Why not consider building a later version, which does not use this special switch assembly? It was published in September 1979 (File No. 3/AU/22). Back issues are available from our Information Service.

METAL LOCATOR: I enjoyed your constructional feature on the "Prospector" metal detector in the November 1979 issue. Are you able to suggest a supplier who could provide all the components in the parts list, together with the PCB and the panel artwork. (H.S., Sorrento, WA.)

● Parts for the Prospector metal ocator are available from the various components suppliers who advertise regularly in "Electronics Australia". ncluded are such firms as Dick Smith Electronics, David Reid Electronics, Radio Despatch Service, Electronic Agencies, and All Electronic Components. At least one of these firms is probably advertising a kit of parts in this very issue.

DC-AC INVERTER: I often read "Electronics Australia", and one item of particular interest is the 12-230V DC-AC inverter which appeared in the February 1979 issue. As I intend to utilise the inverter urgently, could you please tell me of any modifications which would enable me to use this unit for regular domestic purposes. (M.C., Suva, Fiji.)

● No circuit modifications or corrections have been published for the "High Power 12-230V DC-AC Inverter" (File No. 3/IT/10). You can buy the power transformer from Vesco Electronic Supplies, 318 Huntingdale Rd, Huntingdale, Victoria 3166; the 2N3771 power transistors from Radio Despatch Service, 869 George St, Sydney, NSW 2000; or the complete kit from All Electronic Components, 118 Lonsdale St, Melbourne 3000.

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If you are unable to complete an "Electronics Australia" project because you missed out on your regular issue, we can usually provide emergency assistance on the following basis:

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ADDRESS: All requests to the Assistant Editor, "Electronics Australia", Box 163, Beaconsfield, 2014.

Notes & Errata

FAN SPEED CONTROLLER (December 1979, File No. 2/PC/25): On the wiring diagram, the incoming mains active and neutral wires should be swapped over, to agree with the circuit diagram.

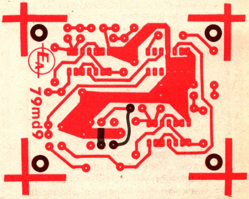
REMOTE CONTROL (October 1979, File No. 1/MS/19): Two components are omitted from the parts list, a .015uF capacitor and a .01uF capacitor, both metallised polyester. There is also an error on the circuit diagram in that pin 5 of IC5 is shown connected to -5 volts as well as pin 10 of IC4. The connection to the -5V does not exist. Actually, on the PCB, pin 5 is also connected to unused pins 12 and 13 of IC5.

6800/D2 TO CHIP-8 ADAPTOR (December 1979, File No. 2/CC/48): There is an error in the second paragraph on page 94. The tone generating subroutines follow at C2DF not C2DA. The initialisation routine at 8004/5 is made available to the D2 user as a subroutine at C305 so he can use the timer, bleeper and keypad routines without running the CHIP-8 interpreter. The circuit on page 93 shows the PIA connector upside down, and on the circuit on pages 90 and 91 the video RAMs (6810) are located at 1C00 to 1C7F and 1C78 to 1CFF.

METAL LOCATOR (November 1979, File No. 3/MS/79). If you are unable to obtain the specified transformer, then it is an easy matter to wind your own. The parts required are as follows: (Neosid part numbers are in brackets) 5mm coil former (722/1), 6 pin base (5027/6PLB), aluminium can (7100) and a 4mm F16 ferrite core. The coil consists of 200 turns of 36 B&S enamelled copper wire wound along half the length of the coil former.

There is also an error on the PCB pattern involving the IF transformer. The board need not be changed if you have wound your own coil, but only if you use the specified Aegis or Jabel coil. The IF transformer has a 6-pin base with two inner pins closer to one side than the other; on the PCB pattern we have mistakenly placed the two inner holes on the wrong side. If the transformer is thus incorrectly installed, it will be open-circuit, and the oscillator will operate spuriously in an RC mode, causing poor sensitivity and constant drifting of pitch.

This is corrected by drilling the two inner holes closer to the opposite side so that the transformer can be rotated round and inserted into the PCB the correct way. Alternatively, leave it as it is and link up the connections to the coil as shown in the diagram of the copper side of the PCB.



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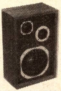

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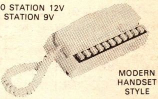

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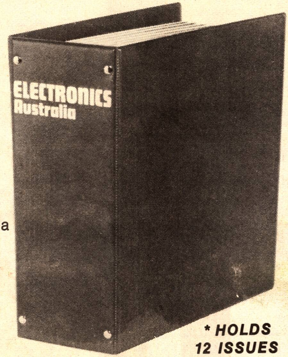

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